Noise and Vibration Analysis
Technical Memorandum for
CREATE Project WA7

January 2014

Purpose

The purpose of this technical memorandum is to evaluate the possible noise and vibration impacts associated with CREATE Project WA7. The analysis documented in this technical memorandum was conducted in accordance with the *CREATE Noise and Vibration Methodology, August 2011*, which is based on Federal Transit Administration (FTA) procedures and impact criteria and is outlined in the Railroad Noise Model User Guide dated 2006.

Background

Specific noise and vibration assessment guidelines developed for assessing noise and vibration impacts of proposed projects within the CREATE Program were used for this analysis. The CREATE assessment methodology was developed because, unlike highway and transit improvement projects, there are no guidance documents or methods specifically applicable for the evaluation of freight train traffic noise and vibration impacts. The FTA has developed a Transit Noise and Vibration Assessment manual dated May 2006 (FTA Manual) for the evaluation of transit projects, but this methodology does not specifically address freight train traffic.

Existing Setting and Noise Measurements

The land use along WA7 project area consists of a mix of residential, commercial, and industrial land uses, as well as three schools, two parks, and the Cook County Sheriff's Vocational Rehabilitation Impact Center. Representative noise measurements were taken at selected sensitive receptors along the WA7 project area in the Fall of 2012. Noise measurement sites were selected based on the proximity of proposed improvements to sensitive noise receptors. The noise measurement results were used to determine existing background noise levels along the WA7 project area.

The purpose of measuring existing noise levels is to determine the appropriate impact criteria based on the *CREATE Noise and Vibration Methodology* noise impact guidelines. Impact thresholds for increases in the cumulative noise exposure vary based on the existing noise level. A total of six short-term measurements were conducted at residential locations along the WA7 project area. The measurements were recorded as one-minute average noise levels (L_{eq}) for at least one hour at each noise measurement location. Measurements were conducted between 10:00 AM and 6:00 PM. Table 1 shows the address where the noise measurements were conducted and the existing noise levels. Figures 1a and 1b show the location of the noise measurement sites.

Table 1 – Existing Noise Measurement Results

Measurement Site	Address/Location	Land use	Date	Start Time	Stop Time	Hourly Noise Level, Leq	Day/Night Noise Level, Ldn
WA7-N1A	3645 S. Maplewood	Residential	11/12/2012	14:47	16:30	48	46
WA7-N1	3736 Campbell	Residential	9/26/2012	11:01	12:25	56	54
WA7-N2	2436 34th Place	Residential	9/26/2012	16:27	17:33	61	59
WA7-N3	2440 24th Place	Residential	9/26/2012	14:04	15:32	52	50
WA7-N4	2601 24th Street	Residential	9/27/2012	10:16	11:19	60	58
WA7-N4A	2609 24th Street	Residential	9/27/2012	10:16	11:21	55	53

Note: L_{dn} values were calculated using FTA procedures and measured L_{eq} values.

In order to determine background noise levels, the noise measurements results were modified to account for the noise sources other than the CREATE freight, commuter, or intercity passenger trains, according to the requirements of the *CREATE Noise and Vibration Methodology*. The goal is to have at least one hour of the measured noise levels at each location that does not include any CREATE program trains. The following procedures presented in the *CREATE Noise and Vibration Methodology* were used to determine the one hour background noise levels without CREATE program trains:

- Continuously measure the overall noise levels at each noise measurement site using one-minute L_{eq} values.
- Record the time interval when CREATE Program trains (i.e. trains traveling on tracks affected by the CREATE Program) pass in front of the noise measurement site.
- Extend the one-hour measurement time by the train event time length.
- Eliminate the one-minute L_{eq} values from the data set for the time intervals the CREATE Program train were pass-by.
- Calculate the hourly L_{eq} using the remaining data sets.

The background L_{dn} (day-night) noise levels without CREATE program trains were then computed from the hourly L_{eq} for residential land uses using the *CREATE Noise and Vibration Methodology*.

Impact Criteria

The FTA methodology included in the FTA Manual is generally applicable for assessing the potential noise and vibration impacts from the proposed CREATE projects; however, due to the differing characteristics of freight trains, some aspects of the FTA methodology have been modified for the purpose of applying it to the CREATE projects. The FTA impact criteria were developed from established basic research on noise annoyance; therefore, they are considered applicable for assessing CREATE impacts. These criteria are applicable to three categories of land use: Category 1 land uses - outdoor areas that require a quiet setting, such as Zen gardens and meditation fields; Category 2 land uses - residences and buildings where people normally sleep, such as homes, prisons, and hotels; and Category 3 land uses - institutional buildings with primarily day time use, such as schools and churches.

There are two levels of impacts cited in the FTA criteria: moderate and severe. A Moderate Impact is a change in the cumulative noise level that is noticeable to most people, but may not be sufficient to cause strong, adverse reactions from the community. A Severe Impact is a change in the cumulative noise level that a significant percentage of people would be highly annoyed by project noise.

The FTA evaluation of vibration impacts can be divided into three categories of land use. Category 1 land uses consists of buildings where vibration would interfere with interior operations, such as manufacturing facilities and hospitals with vibration-sensitive equipment. Category 2 land uses are residences and buildings where people normally sleep. Category 3 land uses are institutional buildings with primarily daytime use.

Noise Impact Analysis

Conducting a noise assessment in accordance to the *CREATE Noise and Vibration Methodology* follows three steps: a Noise Screening Procedure (determining the noise-sensitive receptors within the screening distance), a General Noise Assessment, and a Detailed Noise Analysis (if necessary).

As part of the Noise Screening Procedure, screening distances are used to identify noise-sensitive land uses within certain distances from the project. Sensitive receptors located within these screening distances are evaluated for potential noise and vibration impacts. The General Noise Assessment is conducted based on the procedures specifically developed for CREATE projects and outlined in the *CREATE Railroad Noise Model User Guide, 2006*. Noise levels are predicted at sensitive receptors for the existing conditions and for the future No-Build and Build alternatives. If the General Noise Assessment methods predict potential noise impacts, then the Detailed Noise Analysis methodology is used to refine the analysis to determine if the noise impacts are still predicted. The Detailed Noise Analysis provides the highest degree of accuracy using site-specific topographic information. If noise impacts are identified in the Detailed Noise Analysis, then mitigation will be evaluated in accordance with the *CREATE Noise and Vibration Methodology*.

Screening

A screening distance of 750 feet was established for almost the entire WA7 project area with the exception of one area where the screening distance was 1,200 feet. Figures 1a and 1b show the screening distances used for this project. The closest noise sensitive receptor is located 75 feet from an existing track.

General Noise Assessment

The General Noise Assessment was conducted for the Category 2 and 3 land uses closest to the proposed WA7 improvements. (No Category 1 land uses are located within the screening distances used for this project.) The closest receptors to the track alignment were modeled under the assumption that these locations represent the worst-case noise condition. However, additional second and third row receptors were also modeled to verify there were no other impacts beyond the first row.

Train operational data for 2009 were provided by the Chicago Transportation Coordination Office (CTCO) using the train model developed for the CREATE program. The train data were utilized to calculate noise levels at each of the representative receptors. Train operational data were counted and averaged for the 2009 Existing, 2029 Build, and 2029 No-Build scenarios. After train operation volume counts were entered into the CREATE General Noise Assessment spreadsheet, site-specific parameters such as building rows, train speeds, and track condition information were added for each modeled receptor.

After the existing, no-build, and build noise levels due to trains only were calculated, they were then logarithmically combined with the measured background noise levels at each receptor. The noise level difference between the existing (train plus background) noise level and the build (train plus background) noise level was used to determine noise impacts. General Noise Assessment results indicate a moderate impact at four receptors, but no severe impacts at any receptors. Table 2 shows the General Noise Assessment results.

Table 2 - General Noise Assessment Results

Receptor No.	Land use	Overall Noise Levels (dBA)			Impact
		Existing (2009)	No-Build (2029)	Build (2029)	
WA7-R-01	SFR	59	56	57	No Impact
WA7-R-02	SFR/MFR	57	55	56	No Impact
WA7-R-03	SFR/MFR	55	54	55	No Impact
WA7-R-05	SFR/MFR	55	54	54	No Impact
WA7-R-14	SFR	50	48	49	No Impact
WA7-R-15	SFR/MFR	49	47	48	No Impact
WA7-R-16	SFR	47	47	47	No Impact
WA7-R-17	MFR	50	47	48	No Impact
WA7-R-18	SFR/MFR	48	47	47	No Impact
WA7-S-01	SCH	47	48	48	No Impact
WA7-R-04	SFR/MFR	55	55	55	No Impact
WA7-R-19	SFR/MFR	55	52	53	No Impact
WA7-R-23	SFR	65	62	63	No Impact
WA7-R-24	SFR	62	61	60	No Impact
WA7-R-12	MFR	59	63	61	No Impact
WA7-R-13	SFR	66	70	68	**Moderate**
WA7-P-01	REC	63	64	63	No Impact
WA7-R-25	SFR	68	71	69	No Impact
WA7-R-26	SFR	60	63	61	No Impact
WA7-R-33	SFR	57	61	58	No Impact
WA7-R-34	SFR	54	57	56	No Impact
WA7-R-35	SFR/MFR	68	72	69	No Impact
WA7-R-38	SFR/MFR	60	62	62	No Impact
WA7-R-39	SFR/MFR	69	72	70	No Impact
WA7-R-43	SFR	63	65	64	No Impact
WA7-R-47	MFR	64	68	66	No Impact
WA7-R-7	SFR/MFR	60	60	60	No Impact
WA7-R-8	SFR/MFR	68	71	69	No Impact
WA7-P-02	REC	63	64	63	No Impact
WA7-C-02	PR	66	68	68	**Moderate**
WA7-S-02	SCH	64	66	64	No Impact
WA7-R-50	SFR	70	74	73	**Moderate**
WA7-R-52	SFR/MFR	61	66	65	**Moderate**
WA7-R-53	SFR/MFR	60	63	62	No Impact
WA7-S-03	SCH	67	68	66	No Impact
WA7-R-49	SFR/MFR	59	60	60	No Impact
WA7-R-58	SFR	62	67	64	No Impact
WA7-R-59	SFR/MFR	59	60	59	No Impact

Note: MFR - Mutli-family Residences; SFR - Single-family Residences; Motel - MT; SCH - School; REC - Recreational Area; PR - Prison.

Detailed Noise Analysis

A Detailed Noise Analysis was then performed for the four receptors where moderate noise impacts were identified in the General Noise Assessment. The detailed analysis indicates WA7-C-02 would have a moderate noise impact as a result of the WA7 project. Table 3 shows the detailed analysis results. More information is contained in the Detailed Noise Analysis table in the appendix.

Table 3 - Detailed Noise Analysis Results

Receptor No.	Land use	Overall Noise Levels (dBA)			Impact
		Existing (2009)	No-Build (2029)	Build (2029)	
WA7-R-13	SFR	66	69	67	No Impact
WA7-C-02	PR	65	67	67	**Moderate**
WA7-R-50	SFR	71	72	71	No Impact
WA7-R-52	SFR/MFR	66	68	67	No Impact

Note: MFR - Mutli-family Residences; SFR - Single-family Residences; Motel - MT; SCH - School; REC - Recreational Area; PR - Prison.

Noise Abatement Evaluation

The determination of a moderate noise impact using the Detailed Noise Analysis warrants the evaluation of noise mitigation of the project at the WA7-C-02 receptor location. A noise abatement evaluation was conducted following the guidance in the FTA Manual and the *CREATE Noise and Vibration Methodology*. At WA7-C-02, the noise source is at a higher elevation than the receptor. A noise wall was assumed to be situated at the bottom of the embankment, within railroad right-of-way. According to calculations, a wall 14 feet high would yield a six dBA reduction in train noise. Therefore, a noise wall would achieve the required noise reduction of at least five dBA and is considered feasible. However, construction of a noise barrier is not reasonable because it does not meet cost-effectiveness criteria. Therefore, the construction of a noise barrier is feasible, but not reasonable. Details of the evaluation can be found in the appendix.

L_{max} Estimation

L_{max} was estimated at the four locations in the detailed analysis as prescribed by the *CREATE Noise and Vibration Methodology*. The maximum value for each scenario was estimated to be 81 dbA for 2009 Existing, 80 dbA for 2029 No-Build, and 82 dbA for 2029 Build (all from locomotives). The full table may be seen in the appendix.

Vibration Assessment

Vibration impacts can be a result of both ground-borne vibration (GBV) and ground-borne noise (GBN). Vibration impacts are assessed for a one-time event and based on the maximum vibration level.

According to the *CREATE Noise and Vibration Methodology*, vibration assessment follows three steps: 1) Vibration Screening Procedure, 2) General Vibration Assessment, and 3) Detailed Vibration Analysis (if necessary). The CREATE Vibration Screening Procedure follows the methodology presented in the FTA Manual. If it is determined that there are vibration sensitive land uses along the project area within the screening distances, then a General Vibration Assessment is required. If impacts are identified in the General Vibration Assessment, then a Detailed Vibration Analysis may be used to refine and confirm whether a vibration impact occurs

The Vibration Screening Procedure identified locations along the project alignment that were considered sensitive land uses. Therefore, a General Vibration Assessment for ground-borne vibration and an assessment for ground-borne noise were completed following the guidance in the CREATE methodology. The results of the GBV assessment are shown in Table 4.

Table 4 – GBV Assessment Results Summary

Receptor	Land Use	Source	GBV Levels (VdB)			Potential Impact?
			Existing (2009)	No-Build (2029)	Build (2029)	
WA7-R-25	MFR	Freight - Rail Car	68	71	78	**Yes**
		Freight - Locomotive	69	72	80	**Yes**
WA7-R-26	SFR	Freight - Rail Car	59	62	70	No
		Freight - Locomotive	61	64	71	No
WA7-R-35	SFR/MFR	Freight - Rail Car	64	64	68	No
		Freight - Locomotive	65	65	69	No
WA7-R-39	SFR/MFR	Freight - Rail Car	72	72	76	**Yes**
		Freight - Locomotive	73	73	77	**Yes**
WA7-R-47	SFR/MFR	Freight - Rail Car	65	65	69	No
		Freight - Locomotive	66	66	70	No
WA7-C-02	PR	Freight - Rail Car	60	58	60	No
		Freight - Locomotive	61	59	61	No
WA7-S-02	SCH	Freight - Rail Car	61	60	65	No
		Freight - Locomotive	61	60	65	No
WA7-R-50	SFR	Freight - Rail Car	75	74	79	**Yes**
		Freight - Locomotive	76	75	80	**Yes**
WA7-R-52	SFR/MFR	Freight - Rail Car	73	72	77	**Yes**
		Freight - Locomotive	74	73	78	**Yes**
WA7-S-03	SCH	Freight - Rail Car	64	63	68	No
		Freight - Locomotive	66	65	70	No
WA7-R-23	SFR	Commuter Train	84	83	84	No
		Freight - Locomotive	80	74	81	No
		Freight - Rail Car	79	73	79	No
WA7-R-24	SFR	Commuter Train	79	78	79	No
		Freight - Locomotive	75	69	78	No
		Freight - Rail Car	74	68	77	No

Note: MFR - Mutli-family Residences; SFR - Single-family Residences; Motel - MT; SCH - School; REC - Recreational Area; PR - Prison.

The results of the GBN assessment are show in Table 5.

Table 5 – GBN Assessment Results Summary

Receptor	Land Use	Source	GBN Levels (VdB)			Potential Impact?
			Existing (2009)	No-Build (2029)	Build (2029)	
WA7-R-25	MFR	Freight - Rail Car	18	21	28	No
		Freight - Locomotive	19	22	30	No
WA7-R-26	SFR	Freight - Rail Car	9	12	20	No
		Freight - Locomotive	11	14	21	No
WA7-R-35	SFR/MFR	Freight - Rail Car	14	14	18	No
		Freight - Locomotive	15	15	19	No
WA7-R-39	SFR/MFR	Freight - Rail Car	22	22	26	No
		Freight - Locomotive	23	23	27	No
WA7-R-47	SFR/MFR	Freight - Rail Car	15	15	19	No
		Freight - Locomotive	16	16	20	No
WA7-C-02	PR	Freight - Rail Car	10	8	10	No
		Freight - Locomotive	11	9	11	No
WA7-S-02	SCH	Freight - Rail Car	11	10	15	No
		Freight - Locomotive	11	10	15	No
WA7-R-50	SFR	Freight - Rail Car	25	24	29	No
		Freight - Locomotive	26	25	30	No
WA7-R-52	SFR/MFR	Freight - Rail Car	23	22	27	No
		Freight - Locomotive	24	23	28	No
WA7-S-03	SCH	Freight - Rail Car	14	13	18	No
		Freight - Locomotive	16	15	20	No
WA7-R-23	SFR	Commuter Train	34	33	34	No
		Freight - Locomotive	30	24	31	No
		Freight - Rail Car	29	23	29	No
WA7-R-24	SFR	Commuter Train	29	28	29	No
		Freight - Locomotive	25	19	28	No
		Freight - Rail Car	24	18	27	No

Note: MFR - Mutli-family Residences; SFR - Single-family Residences; Motel - MT; SCH - School; REC - Recreational Area; PR - Prison.

These assessments indicate four potential GBV impacts (due to freight locomotives and rail cars) and no GBN impacts as a result of the WA7 project. Three of these moderate impacts are located on the east side of the Western Avenue Corridor where there is no proposed work under this project. The fourth impact is in the area of the new wye at Brighton Park. There is no special track work in the immediate area of the connection. Where GBV or GBN impacts are indicated in the *CREATE Noise and Vibration Methodology*, a Detailed Vibration Analysis is required only when planning and design of special track work or buffer zones are viable mitigation measures. Planning and design of special track work is not a viable mitigation option because most tracks in the WA7 project area are existing tracks. Similarly, additional buffer zones are not viable mitigation options in the WA7 project corridor.

The following maintenance procedures will be accomplished by the rail industry to mitigate vibration impacts through the minimizing of vibration sources:

- Regularly scheduled rail grinding
- Wheel truing programs
- Vehicle reconditioning programs
- Use of wheel-flat detectors.

Construction Noise and Vibration

The construction of the proposed project could result in temporary noise and vibration increases within and adjacent to the project area. The noise and vibration will be generated primarily from trucks and heavy machinery used during construction. Any anticipated noise and vibration impacts will likely be confined to normal working hours, which are generally considered to be "noise and vibration tolerant" periods. Construction contractors need to be aware of local noise ordinances to assure compliance in Cook County and within the cities that construction activities occur. No adverse noise and vibration impacts are anticipated during the construction phase of the project. Vibration impacts typically include both ground-borne vibration and ground-borne noise.

Conclusion

One moderate impact was identified in the detailed noise analysis. A noise abatement evaluation determined that a noise wall is feasible, but not reasonable. The general vibration assessment identified potential GBV impacts at four receptors. However, providing buffer zones and moving special track work are not viable mitigation options for this project. The noise and vibration analyses for this project may need to be reassessed if: a) the project is revised in a manner in which impacts of the project may change due to the project revisions (e.g., a new track alignment is moved closer to a receptor), or b) the CREATE Program's train model is updated due to projects being removed or added to the CREATE Program.

Detailed tables for the noise and vibration analyses are provided in Appendix A.

Appendix A

Tables:

- General Noise Assessment
- Detailed Noise Analysis Summary
- Noise Abatement Evaluation
- Summary of L_{max} Estimation
- General Vibration Assessment Calculations (Build and No-Build)

Figures:

- Figure 1 – Noise Analysis: Screening Distance and Receptor Cluster Maps
- Figure 2 – Vibration Analysis: Screening Distance and Receptor Cluster Maps

General Noise Assessment

Site No.	FTA Land Use/ Noise Metric[1]	No. of Buildings Within Cluster	Exisiting Land Use[2]	Background Noise Level, dBA[3]	Predicted Overall Noise Levels, dBA[4]			Build Increase Over Existing, dBA	FTA Allowable Increase, dBA Moderate/ Severe	FTA Impact Level
					Existing (2009)	No-Build (2029)	Build (2029)			
WA7-R-01	2/ L_{dn}	9	SFR	54	59	56	57	-2	2/5	No Impact
WA7-R-02	2/ L_{dn}	13	SFR/MFR	54	57	55	56	-1	3/6	No Impact
WA7-R-03	2/ L_{dn}	9	SFR/MFR	54	55	54	55	-1	3/7	No Impact
WA7-R-05	2/ L_{dn}	35	SFR/MFR	54	55	54	54	0	3/7	No Impact
WA7-R-14	2/ L_{dn}	12	SFR	46	50	48	49	-2	5/10	No Impact
WA7-R-15	2/ L_{dn}	10	SFR/MFR	46	49	47	48	-1	6/11	No Impact
WA7-R-16	2/ L_{dn}	4	SFR	46	47	47	47	0	7/12	No Impact
WA7-R-17	2/ L_{dn}	16	MFR	46	50	47	48	-1	5/10	No Impact
WA7-R-18	2/ L_{dn}	5	SFR/MFR	46	48	47	47	-1	6/12	No Impact
WA7-S-01	3/ L_{eq}	1	SCH	46	47	48	48	1	11/17	No Impact
WA7-R-04	2/ L_{dn}	43	SFR/MFR	54	55	55	55	0	3/7	No Impact
WA7-R-19	2/ L_{dn}	54	SFR/MFR	46	55	52	53	-2	3/7	No Impact
WA7-R-23	2/ L_{dn}	36	SFR	46	65	62	63	-2	1/4	No Impact
WA7-R-24	2/ L_{dn}	13	SFR	46	62	61	60	-2	2/4	No Impact
WA7-R-12	2/ L_{dn}	2	MFR	54	59	63	61	2	2/5	No Impact
WA7-R-13	2/ L_{dn}	3	SFR	54	66	70	68	2	1/4	Moderate
WA7-P-01	3/ L_{eq}	-	REC	54	63	64	63	0	4/8	No Impact
WA7-R-25	2/ L_{dn}	4	SFR	46	68	71	69	1	1/3	No Impact
WA7-R-26	2/ L_{dn}	14	SFR	46	60	63	61	1	2/5	No Impact
WA7-R-33	2/ L_{dn}	22	SFR	46	57	61	58	1	3/6	No Impact
WA7-R-34	2/ L_{dn}	20	SFR	46	54	57	56	2	3/8	No Impact
WA7-R-35	2/ L_{dn}	17	SFR/MFR	59	68	72	69	1	1/3	No Impact
WA7-R-38	2/ L_{dn}	18	SFR/MFR	59	60	62	62	2	2/5	No Impact

General Noise Assessment

Site No.	FTA Land Use/ Noise Metric[1]	No. of Buildings Within Cluster	Exisiting Land Use[2]	Background Noise Level, dBA[3]	Predicted Overall Noise Levels, dBA[4]			Build Increase Over Existing, dBA	FTA Allowable Increase, dBA Moderate/ Severe	FTA Impact Level
					Existing (2009)	No-Build (2029)	Build (2029)			
WA7-R-39	2/ L_{dn}	13	SFR/MFR	59	69	72	70	1	1/3	No Impact
WA7-R-43	2/ L_{dn}	66	SFR	59	63	65	64	1	2/4	No Impact
WA7-R-47	2/ L_{dn}	5	MFR	59	64	68	66	2	2/4	No Impact
WA7-R-7	2/ L_{dn}	14	SFR/MFR	59	60	60	60	0	2/5	No Impact
WA7-R-8	2/ L_{dn}	22	SFR/MFR	59	68	71	69	1	1/3	No Impact
WA7-P-02	3/ L_{eq}	0	REC	59	63	64	63	0	4/8	No Impact
WA7-C-02	2/ L_{dn}	9	PR	58	66	68	68	2	1/4	Moderate
WA7-S-02	3/ L_{eq}	1	SCH	50	64	66	64	0	4/8	No Impact
WA7-R-50	2/ L_{dn}	5	SFR	50	70	74	73	3	1/3	Moderate
WA7-R-52	2/ L_{dn}	11	SFR/MFR	50	61	66	65	4	2/5	Moderate
WA7-R-53	2/ L_{dn}	23	SFR/MFR	50	60	63	62	2	2/5	No Impact
WA7-S-03	3/ L_{eq}	1	SCH	50	67	68	66	-1	3/7	No Impact
WA7-R-49	2/ L_{dn}	8	SFR/MFR	58	59	60	60	1	2/5	No Impact
WA7-R-58	2/ L_{dn}	2	SFR	50	62	67	64	2	2/4	No Impact
WA7-R-59	2/ L_{dn}	9	SFR/MFR	58	59	60	59	0	2/5	No Impact

Notes:

1 - FTA Noise Impact Criteria apply 24-hour L_{dn} for residents and prisons (Land Use Category 2) and hourly L_{eq} for schools and recreational areas (Land Use Category 3).

2 - MFR - Mutli-family Residences; SFR - Single-family Residences; Motel - MT; SCH - School; REC - Recreational Area; PR - Prison.

3 - Background noise levels determined from one-hour measurement data or from a representative location.

4 - Overall noise levels are the logarithmic addition of the background noise level (without trains) and predicted train noise under the existing, no-build, and build conditions. Existing, no-build and build train noise levels were predicted using the FTA General Assessment spreadsheet (CREATE Version).

Detailed Noise Analysis

Site No.	FTA Land Use/ Noise Metric[1]	No. of Buildings Within Cluster	Exisiting Land Use[2]	Background Noise Level, dBA[3]	Predicted Overall Noise Levels, dBA[4]			Build Increase Over Existing, dBA	FTA Allowable Increase, dBA Moderate/ Severe	FTA Impact Level
					Existing (2009)	No-Build (2029)	Build (2029)			
WA7-R-13	2/ L_{dn}	3	SFR	54	66	69	67	1	1/4	No Impact
WA7-C-02	2/ L_{dn}	9	PR	58	65	67	67	2	1/4	**Moderate**
WA7-R-50	2/ L_{dn}	5	SFR	50	71	72	71	0	1/3	No Impact
WA7-R-52	2/ L_{dn}	11	SFR/MFR	50	66	68	67	1	1/4	No Impact

Notes:

1 - FTA Noise Impact Criteria apply 24-hour L_{dn} for residents and prisons (Land Use Category 2) and hourly L_{eq} for schools and recreational areas (Land Use Category 3).

2 - MFR - Mutli-family Residences; SFR - Single-family Residences; Motel - MT; SCH - School; REC - Recreational Area; PR - Prison.

3 - Background noise levels determined from one-hour measurement data or from a representative location.

4 - Overall noise levels are the logarithmic addition of the background noise level (without trains) and predicted train noise under the existing, no-build, and build conditions. Existing, no-build and build train noise levels were predicted using the FTA General Assessment spreadsheet (CREATE Version).

Assessment Level: Abatement Evaluation

Receptor	WA7-C-02
Noise Metric	L_{dn}
Existing Overall Noise Exposure	65 dBA
Build Overall Noise Exposure	67 dBA
Increase in Overall Noise Exposure	2 dBA
Allowable increase before moderate impact	1 dBA
Allowable increase before severe impact	4 dBA
Impact Level	Moderate
Increase over Moderate Impact Threshold[1]	1
Number of Benefited Receptors[2]	9
Reasonable Cost per Benefited Receptor[3]	$5,000
Reasonable Cost of Noise Wall[4]	$45,000
Potential Noise Wall Location	At bottom of Embankment
Noise Wall Height[5]	16 ft
Approximate Noise Wall Length[6]	950 ft
Unit Noise Wall Cost[7]	$37.50
Total Noise Wall Cost[8]	$570,000
Train Noise Reduction due to Soundwall	6 dBA
Does Noise Wall Achieve Noise Reduction Goal?[9]	Yes
Does Noise Wall Achieve the Economic Reasonability Policy Value?[10]	No
Is Noise Wall Likely to be Implemented?	No

Notes:

1 - "Increase over the Moderate Impact Threshold" is the "Increase in Overall Noise Exposure" minus the "Allowable increase before moderate impact".

2 - A benefited receptor is a receptor with predicted noise impacts and that receives a Build Scenario CREATE Program Train Noise Level (Design Year) noise reduction of 5 dBA or more.

3 - For severe impacts, an upper limit of $30,000 per benefited receptor. For moderate impacts, an upper limit of $5,000 per benefited receptor for each decibel meeting or exceeding the impact threshold, up to $30,000 per dwelling.

4 - "Reasonable Cost of Noise Wall" is the product of the "Reasonable Cost per Benefited Receptor" and the total "Number of Benefited Receptors". For multiple clusters benefited by one noise wall, it is the sum of the individual clusters' products. This is the maximum noise wall cost that would be economically reasonable under the policy.

5 - The height of a noise wall necessary to achieve a noise reduction goal of 5 dBA or more in future CREATE Program train noise.

6 - Potential wall is at least the length of the cluster footprint exposed to the train noise. The length would additionally extend in each direction from the receptor cluster for distance of 4 times the distance between receptor and the closest track in the Build condition.

7 - Noise wall costs are based on $25.00 per square foot unit cost for walls up to 15 feet tall; $37.50 per square foot up to 30 feet tall; and $50.00 per square foot up to 45 feet tall.

8 - "Total Noise Wall Cost" is the product of the "Unit Noise Wall Cost" and the noise wall surface area.

9 - Noise mitigation measures must provide a Build Scenario CREATE Program Train Noise Level (Design Year - noise reduction of at least 5 dBA for the mitigation measure to be considered feasible.

10 - Does the "Reasonable Cost of the Noise Wall" exceed the "Total Noise Wall Cost"? If "Yes", then the noise wall achieves the Economic Reasonability Policy Value.

CREATE WA7 Noise Analysis
April 2013

L_{max} Estimation

Receptor	Track	Existing (2009) L_{max} Loco's	Existing (2009) L_{max} Cars	No-Build (2029) L_{max} Loco's	No-Build (2029) L_{max} Cars	Build (2029) L_{max} Loco's	Build (2029) L_{max} Cars
WA7-R-50	CJ2	80	68	79	67	82	71
	CJ3	78	67	79	67	82	70
	CSX 1	81	71	80	69	81	70
	CSX 2	79	68	78	67	80	70
	NS					77	65
	BNSF					76	73
	Max	81		80		82	
WA7-R-52	CJ2	78	68	77	67	80	71
	CJ3	77	67	77	67	80	70
	CSX 1	79	71	79	69	79	70
	CSX 2	77	68	76	67	79	70
	NS					75	65
	BNSF					74	73
	Max	79		79		80	
WA7-C-2	CJ2	76	68	75	67	78	71
	CJ3	75	67	76	67	78	70
	CSX 1	78	71	78	69	79	70
	CSX 2	77	68	76	67	79	70
	NS					76	65
	BNSF					76	73
	Max	78		78		79	
WA7-R-13	CSX 2	79	69	78	68	79	70
	CSX 1	78	70	77	67	79	70
	CJ3	75	67	75	66	78	70
	CJ2	76	68	76	67	78	70
	Max	79		78		79	
Project Maximum		81		80		82	

Vibration General Assessment Report Form For Source Calculations:
CREATE Project WA7

Heavily Used Rail Corridor (existing train volume >12 trains/day)
Freight Locomotives

Receptors	Peak Day Existing Volumes	Peak Day Predicted Build Volumes	Existing Impact Frequency Category [1]	Predicted Build Impact Frequency Category [1]	Distance[2] Existing Track 1 (feet)	Distance[2] Existing Track 2 (feet)	Distance[2] Proposed Track 1 (feet)	Distance[1] Proposed Track 2 (feet)	Distance[1] Proposed Track 3 (feet)	Generalized Vibration Curve[3] Existing Track 1 (VdB)	Generalized Vibration Curve[3] Existing Track 2 (VdB)	Generalized Vibration Curve[3] Proposed Track 1 (VdB)	Generalized Vibration Curve[3] Proposed Track 2 (VdB)	Generalized Vibration Curve[3] Proposed Track 3 (VdB)	Highest[4] Predicted Existing Vibration Level at Each Receptor (VdB)	Highest[4] Predicted Build Vibration Level at Each Receptor (VdB)
WA7-R-23	7	4	infrequent	infrequent	43	56	43	56	30	85	83	85	83	88	85	88
WA7-R-24	7	4	infrequent	infrequent	66	79	66	79	33	82	80	82	80	87	82	87

Notes:

[1] Determine if event is frequent; occasional or infrequent event. Refer to Table 7-1 for definition.

[2] Distances measured from centerlines of existing and proposed tracks to faces of buildings.

[3] Generalized Ground Surface Vibration Curve (Figure 10-1) for locomotive-powered passenger or freight trains at 50 mph.

[4] Highest vibration level, from the Generalized Vibration Curve (Figure 10-1), of either Track 1 or Track 2 at each receptor. The example project assumes the same adjustments are applied to both tracks. If the same adjustments cannot be applied to all tracks, the analyst may have to apply adjustments to the tracks individually to determine the highest predicted vibration at each receptor.

The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing moved existing tracks. When analyzing moved existing tracks, the "Predicted Build" considers the total number of trains using those tracks in the design year to determine the frequency category (frequent, occasional or infrequent) and impact level in Table 7-1, as well as the vibration level.

Vibration General Assessment Report Form For **Heavily Used Rail Corridor (existing train volume >12 trains/day)**
Vibration Adjustment Factors **Freight Locomotives**
CREATE Project WA7

	Unadjusted		Existing Adjustments									Predicted Build Adjustments									Adjusted	
		Speed Adjustments			Source Adjustments		Path Adjustments			Receiver Adjustments		Speed Adjustments		Source Adjustments		Path Adjustments			Receiver Adjustments			
Receptors	Highest[1] Vibration Level @ 50 mph at Each Receptor Existing (VdB)	Highest[1] Vibration Level @ 50 mph at Each Receptor Predicted Build (VdB)	Average Track Speed - Existing (mph)	Speed Adjustment Existing (VdB)	Vehicle[2] Condition - Existing (VdB)	Elevated Structure[3] Adjustment Existing (VdB)	Propagation Geology[4] Adjustment Existing (VdB)	Wood Frame Structure (VdB)	Masonry Structure (VdB)	1-5 Floors Above Grade (VdB)	Floor Amplifi-cation (VdB)	Average Track Speed - Predicted Build (mph)	Speed Adjustment - Predicted Build (VdB)	Vehicle[2] Condition - Existing (VdB)	Elevated Structure[3] Adjustment - Predicted Build (VdB)	Propagation Geology[4] Adjustment Existing (VdB)	Wood Frame Structure (VdB)	Masonry Structure (VdB)	1-5 Floors Above Grade (VdB)	Floor Amplifi-cation (VdB)	Predicted Existing Vibration (VdB)	Predicted Build Vibration (VdB)
WA7-R-23	85	88	18	-9	0	-5	10	-5		-2	6	14	-11	0	-5	10	-5		-2	6	80	81
WA7-R-24	82	87	18	-9	0	-5	10		-7	-2	6	14	-11	0	-5	10		-7	-2	6	75	78

Notes:

[1] Highest Vibration Level, from the Generalized Vibration Curve (Figure 10-1), of either the Southbound (Track 1) or Northbound (Track 2) at each receptor.

[2] Worn wheel adjustment made for Freight Rail Car. For locomotives assume no worn wheel adjustment

[3] Existing and proposed tracks are elevated structure/embankment, because both the existing and proposed tracks would be at least 1 feet higher than the base elevation at all receptors

[4] Existing and proposed geological conditions assumed to have "efficient" vibration propagation.

The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing moved existing tracks. When analyzing moved existing tracks, the "Predicted Build" considers the total number of trains using those tracks in the design year to determine the frequency category (frequent, occasional or infrequent) and impact level in Table 7-1, as well as the vibration level.

Vibration General Assessment Report Form For
Vibration Impact Summary
CREATE Project WA7

Heavily Used Rail Corridor (existing train volume >12 trains/day)
Freight Locomotives

Ground-borne Vibration (GBV) Impacts													
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Receptors	FTA [2] Vibration Land Use Category	Existing Vibration Frequency event [1]	Existing FTA Vibration Impact Criteria [3] (VdB)	Predicted Build Vibration Frequency event [1]	Predicted Build FTA Vibration Impact Criteria [3] (VdB)	Predicted Existing Vibration (VdB)	Predicted Build Vibration (VdB)	Difference between Predicted Existing Vibration and Predicted Build Vibration (VdB)	Does Predicted Existing Vibration equal or exceed the FTA impact criteria in Column 4? If Yes, go to Column 11. If No, go to Column 13.	Does the ratio of Build Train Events to Existing Train Events equal or exceed 2? If Yes, go to Column 14 and indicate "Yes." If No, go to column 12 [4]	Does the Predicted Build vibration exceed the Predicted Existing vibration by 3 VdB or Greater? If Yes, go to Column 14 and indicate "Yes" - there is a Potential Impact. If No, go to Column 14 and indicate "No" - there is No Potential Impact. [4]	Does Predicted Build Ground-borne Vibration equal or exceed the FTA impact criteria in Column 6? If Yes, go to Column 14 and indicate "Yes" - there is a Potential Impact. If No, go to Column 14 and indicate "No" - there is No Potential Impact. [4]	Potential impact? If Yes, proceed to Detailed Analysis if mitigation measures are viable.
WA7-R-23	2	infrequent	80	infrequent	80	80	81	1	Yes	No	No	NA	No
WA7-R-24	2	infrequent	80	infrequent	80	75	78	3	No	NA	NA	No	No

Notes:

[1] Determine if event is frequent; occasional or infrequent event. Refer to Table 7-1 for definition.

[2] FTA Vibration Land Use Category #2 includes residences and other buildings where people normally sleep, and Category Land Use #3 includes institutional land uses with primarily daytime uses, such as schools and churches.

[3] Source Table 7-1

[4] See Source Calculations for existing and build volumes and refer to Section 7.2.2 item #3

NA = Not applicable

The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing moved existing tracks. When analyzing moved existing tracks, the "Predicted Build" considers the total number of trains using those tracks in the design year to determine the frequency category (frequent, occasional or infrequent) and impact level in Table 7-1, as well as the vibration level.

Vibration General Assessment Report Form For
GBN Impact Summary
CREATE Project WA7

Heavily Used Rail Corridor (existing train volume >12 trains/day)
Freight Locomotives

Ground-borne Noise (GBN) Impacts

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Receptors	FTA [2] Vibration Land Use Category	Existing GBN Frequency event [1]	Existing-FTA GBN Impact Criteria [3] (dBA)	Predicted Build GBN Frequency event [1]	Predicted Build FTA GBN Impact Criteria [3] (dBA)	Predicted Existing GBN (dBA) [5]	Predicted Build GBN (dBA) [5]	Difference between Predicted Existing GBN and Predicted Build GBN (dBA)	Does the Predicted Existing GBN equal or exceed the FTA impact criteria in Column 4? If Yes, go to Column 11. If No, go to Column 13.	Does the ratio of Predicted Build train impact events to Existing equal or exceed 2? If Yes, go to Column 14 and indicate "Yes." If no, go to column 12 [4]	Does the Predicted Build GBN exceed the Predicted Existing GBN by 3 dBA or greater? If yes, go to Column 14 and indicate "Yes" - there is a Potential Impact. If No, go to Column 14 and indicate "No" - there is No Potential Impact. [4]	Does Predicted Build GBN equal or exceed the FTA impact criteria in Column 6? If Yes, go to Column 14 and indicate "Yes" - there is a Potential Impact. If No, go to Column 14 and indicate "No" - there is No Potential Impact. [4]	Potential Impact? If Yes, proceed to Detailed Analysis if mitigation measures are viable.
WA7-R-23	2	infrequent	43	infrequent	43	30	31	1	No	NA	NA	No	No
WA7-R-24	2	infrequent	43	infrequent	43	25	28	3	No	NA	NA	No	No

Notes:

[1] Determine if event is frequent; occasional or infrequent event. Refer to Table 7-1 for definition.

[2] FTA Vibration Land Use Category #2 includes residences and other buildings where people normally sleep, and Category Land Use #3 includes institutional land uses with primarily daytime uses, such as schools and churches.

[3] Source Table 7-1

[4] See Source Calculations for existing and build volumes and refer to Section 7.2.2 item #3

[5] Assumes adjustment of -50 dBA for low frequency vibration sources (FTA Manual Table 10-1).

NA = Not applicable

The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing moved existing tracks. When analyzing moved existing tracks, the "Predicted Build" considers the total number of trains using those tracks in the design year to determine the frequency category (frequent, occasional or infrequent) and impact level in Table 7-1, as well as the vibration level.

Vibration General Assessment Report Form For Source Calculations:
CREATE Project WA7

Heavily Used Rail Corridor (existing train volume >12 trains/day)
Freight Rail Car

Receptors	Peak Day Existing Volumes	Peak Day Predicted Build Volumes	Existing Impact Frequency Category [1]	Build Impact Frequency Category [1]	Distance[2] Existing Track 1 (feet)	Distance[2] Existing Track 2 (feet)	Distance[2] Proposed Track 1 (feet)	Distance[1] Proposed Track 2 (feet)	Distance[1] Proposed Track 3 (feet)	Generalized Vibration Curve[3] Existing Track 1 (VdB)	Generalized Vibration Curve[3] Existing Track 2 (VdB)	Generalized Vibration Curve[3] Proposed Track 1 (VdB)	Generalized Vibration Curve[3] Proposed Track 2 (VdB)	Generalized Vibration Curve[3] Proposed Track 3 (VdB)	Highest[4] Predicted Existing Vibration Level at Each Receptor (VdB)	Highest[4] Predicted Build Vibration Level at Each Receptor (VdB)
WA7-R-23	7	4	frequent	frequent	43	56	43	56	30	74	72	74	72	76	74	76
WA7-R-24	7	4	frequent	frequent	66	79	66	79	33	71	69	71	69	76	71	76

Notes:

[1] Determine if event is frequent; occasional or infrequent event. Refer to Table 7-1 for definition.

[2] Distances measured from centerlines of existing and proposed tracks to faces of buildings.

[3] Generalized Ground Surface Vibration Curve (Figure 10-1) for rapid transit or light rail vehicles at 50 mph

[4] Highest vibration level, from the Generalized Vibration Curve (Figure 10-1), of either Track 1 or Track 2 at each receptor. The example project assumes the same adjustments are applied to both tracks. If the same adjustments cannot be applied to all tracks, the analyst may have to apply adjustments to the tracks individually to determine the highest predicted vibration at each receptor.

The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing moved existing tracks. When analyzing moved existing tracks, the "Predicted Build" considers the total number of trains using those tracks in the design year to determine the frequency category (frequent, occasional or infrequent) and impact level in Table 7-1, as well as the vibration level.

Vibration General Assessment Report Form For **Heavily Used Rail Corridor (existing train volume >12 trains/day)**
Vibration Adjustment Factors **Freight Rail Car**
CREATE Project WA7

	Unadjusted		Existing Adjustments									Predicted Build Adjustments									Adjusted	
		Speed Adjustments			Source Adjustments		Path Adjustments			Receiver Adjustments		Speed Adjustments		Source Adjustments		Path Adjustments			Receiver Adjustments			
Receptors	Highest[1] Vibration Level @ 50 mph at Each Receptor Existing (VdB)	Highest[1] Vibration Level @ 50 mph at Each Receptor Predicted Build (VdB)	Average Track Speed - Existing (mph)	Speed Adjustment - Existing (VdB)	Vehicle[2] Condition Existing (VdB)	Elevated Structure[3] Adjustment Existing (VdB)	Propagation Geology[4] Adjustment Existing (VdB)	Wood Frame Structure (VdB)	Masonry Structure (VdB)	1-5 Floors Above Grade (VdB)	Floor Amplifi-cation (VdB)	Average Track Speed - Predicted Build (mph)	Speed Adjustment - Predicted Build (VdB)	Vehicle[2] Condition Existing (VdB)	Elevated Structure[3] Adjustment - Predicted Build (VdB)	Propagation Geology[4] Adjustment Existing (VdB)	Wood Frame Structure (VdB)	Masonry Structure (VdB)	1-5 Floors Above Grade (VdB)	Floor Amplifi-cation (VdB)	Predicted Existing Vibration (VdB)	Predicted Build Vibration (VdB)
WA7-R-23	74	76	18	-9	10	-5	10	-5	0	-2	6	14	-11	10	-5	10	-5	0	-2	6	79	79
WA7-R-24	71	76	18	-9	10	-5	10	0	-7	-2	6	14	-11	10	-5	10	0	-7	-2	6	74	77

Notes:

[1] Highest Vibration Level, from the Generalized Vibration Curve (Figure 10-1), of either the Southbound (Track 1) or Northbound (Track 2) at each receptor

[2] Worn wheel adjustment made for Freight Rail Car. For locomotives assume no worn wheel adjustment

[3] Existing and proposed tracks are elevated structure/embankment, because both the existing and proposed tracks would be at least 1 feet higher than the base elevation at all receptor

[4] Existing and proposed geological conditions assumed to have "efficient" vibration propagation.

The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing moved existing tracks. When analyzing moved existing tracks, the "Predicted Build" considers the total number of trains using those tracks in the design year to determine the frequency category (frequent, occasional or infrequent) and impact level in Table 7-1, as well as the vibration level.

Vibration General Assessment Report Form For
Vibration Impact Summary
CREATE Project WA7

Heavily Used Rail Corridor (existing train volume >12 trains/day)
Freight Rail Car

Ground-borne Vibration (GBV) Impacts													
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Receptors	FTA [2] Vibration Land Use Category	Existing Vibration Frequency event [1]	Existing-FTA Vibration Impact Criteria [3] (VdB)	Predicted Build Vibration Frequency event [1]	Proposed FTA Vibration Impact Criteria [3] (VdB)	Predicted Existing Vibration (VdB)	Predicted Build Vibration (VdB)	Difference between Predicted Existing vibration and Predicted Build vibration (VdB)	Does the Predicted Existing vibration equal or exceed the FTA impact criteria in Column 4? If Yes, go to Column 11. If No, go to Column 13.	Does the ratio of Predicted Build train impact events to Existing equal or exceed 2? If Yes, go to Column 14 and indicate "Yes". If No, go to column 12 [4]	Does the Predicted Build vibration exceed the Predicted Existing vibration by 3 VdB or greater? If Yes, go to Column 14 and indicate "Yes" - there is a Potential Impact. If No, go to Column 14 and indicate "No" - there is No Potential Impact. [4]	Does the Predicted Build vibration equal or exceed the FTA impact criteria in Column 6? If Yes, go to Column 14 and indicate "Yes" - there is a Potential Impact. If No, go to Column 14 and indicate "No" - there is No Potential Impact. [4]	Potential Impact? If Yes, proceed to Detailed Analysis if mitigation measures are viable.
WA7-R-23	2	frequent	72	frequent	72	79	79	0	Yes	No	No	NA	No
WA7-R-24	2	frequent	72	frequent	72	74	77	3	Yes	No	No	NA	No

Notes:

[1] Determine if event is frequent; occasional or infrequent event. Refer to Table Table 7-1 for definition.

[2] FTA Vibration Land Use Category #2 includes residences and other buildings where people normally sleep, and Category Land Use #3 includes institutional land uses with primarily daytime uses, such as schools and churches.

[3] Source Table 7-1

[4] See Source Calculations for existing and build volumes and refer to Section 7.2.2 item #3

NA = Not applicable

The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing moved existing tracks. When analyzing moved existing tracks, the "Predicted Build" considers the total number of trains using those tracks in the design year to determine the frequency category (frequent, occasional or infrequent) and impact level in Table 7-1, as well as the vibration level.

Vibration General Assessment Report Form For
GBN Impact Summary
CREATE Project WA7

Heavily Used Rail Corridor (existing train volume >12 trains/day)
Freight Rail Car

Ground-borne Noise (GBN) Impacts

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Receptors	FTA [2] Vibration Land Use Category	Existing GBN Frequency event [1]	Existing-FTA GBN Impact Criteria [3] (dBA)	Predicted Build GBN Frequency event [1]	Proposed FTA GBN Impact Criteria [3] (dBA)	Predicted Existing GBN (dBA) [5]	Predicted Build GBN (dBA) [5]	Difference between Predicted Existing GBN and Predicted Build GBN (dBA)	Does the Predicted Existing GBN equal or exceed the FTA impact criteria in Column 4? If Yes, go to Column 11. If No, go to Column 13.	Does the ratio of Predicted Build train impact events to Existing equal or exceed 2? If Yes, go to Column 14 and indicate "Yes." If No, go to column 12. [4]	Does the Predicted Build GBN exceed the Predicted Existing GBN by 3 dBA or greater? If Yes, go to Column 14 and indicate "Yes" - there is a Potential Impact. If No, go to Column 14 and indicate "No" - there is No Potential Impact. [4]	Does the Predicted Build GBN equal or exceed the FTA impact criteria in Column 6? If Yes, go to Column 14 and indicate "Yes" - there is a Potential Impact. If No, go to Column 14 and indicate "No" - there is No Potential Impact. [4]	Potential Impact? If Yes, proceed to Detailed Analysis if mitigation measures are viable.
WA7-R-23	2	frequent	35	frequent	35	29	29	0	No	NA	NA	No	No
WA7-R-24	2	frequent	35	frequent	35	24	27	3	No	NA	NA	No	No

Notes:

[1] Determine if event is frequent; occasional or infrequent event. Refer to Table 7-1 for definition.

[2] FTA Vibration Land Use Category #2 includes residences and other buildings where people normally sleep, and Category Land Use #3 includes institutional land uses with primarily daytime uses, such as schools and churches.

[3] Source Table 7-1

[4] See Source Calculations for existing and build volumes and refer to Section 7.2.2 item #3

[5] Assumes adjustment of -50 dB for low frequency vibration sources (FTA Manual Table 10-1).

NA = Not applicable

The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing moved existing tracks. When analyzing moved existing tracks, the "Predicted Build" considers the total number of trains using those tracks in the design year to determine the frequency category (frequent, occasional or infrequent) and impact level in Table 7-1, as well as the vibration level.

Vibration General Assessment Report Form For Source Calculations:
CREATE Project WA7

Heavily Used Rail Corridor (existing train volume >12 trains/day)
Commuter Locomotives

Receptors	Peak Day Existing Volumes	Peak Day Predicted Build Volumes	Existing Impact Frequency Category [1]	Predicted Build Impact Frequency Category [1]	Distance[2] Existing Track 1 (feet)	Distance[2] Existing Track 2 (feet)	Distance[2] Proposed Track 1 (feet)	Distance[1] Proposed Track 2 (feet)	Distance[1] Proposed Track 3 (feet)	Generalized Vibration Curve[3] Existing Track 1 (VdB)	Generalized Vibration Curve[3] Existing Track 2 (VdB)	Generalized Vibration Curve[3] Proposed Track 1 (VdB)	Generalized Vibration Curve[3] Proposed Track 2 (VdB)	Generalized Vibration Curve[3] Proposed Track 3 (VdB)	Highest[4] Predicted Existing Vibration Level at Each Receptor (VdB)	Highest[4] Predicted Build Vibration Level at Each Receptor (VdB)
WA7-R-23	16	24	infrequent	infrequent	43	56	43	56	--	85	83	85	83	--	85	85
WA7-R-24	16	24	infrequent	infrequent	66	79	66	79	--	82	80	82	80	--	82	82

Notes:

[1] Determine if event is frequent; occasional or infrequent event. Refer to Table 7-1 for definition.

[2] Distances measured from centerlines of existing and proposed tracks to faces of buildings.

[3] Generalized Ground Surface Vibration Curve (Figure 10-1) for locomotive-powered passenger or freight trains at 50 mph.

[4] Highest vibration level, from the Generalized Vibration Curve (Figure 10-1), of either Track 1 or Track 2 at each receptor. The example project assumes the same adjustments are applied to both tracks. If the same adjustments cannot be applied to all tracks, the analyst may have to apply adjustments to the tracks individually to determine the highest predicted vibration at each receptor.

The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing moved existing tracks. When analyzing moved existing tracks, the "Predicted Build" considers the total number of trains using those tracks in the design year to determine the frequency category (frequent, occasional or infrequent) and impact level in Table 7-1, as well as the vibration level.

Vibration General Assessment Report Form For **Heavily Used Rail Corridor (existing train volume >12 trains/day)**
Vibration Adjustment Factors **Commuter Locomotives**
CREATE Project WA7

	Unadjusted		Existing Adjustments									Predicted Build Adjustments									Adjusted	
			Speed Adjustm	occasional	Source Adjustments		Path Adjustments			Receiver Adjustments		Speed Adjustments		Source Adjustments		Path Adjustments			Receiver Adjustments			
Receptors	Highest[1] Vibration Level @ 50 mph at Each Receptor Existing (VdB)	Highest[1] Vibration Level @ 50 mph at Each Receptor Predicted Build (VdB)	Average Track Speed - Existing (mph)	Speed Adjustment Existing (VdB)	Vehicle[2] Condition - Existing (VdB)	Elevated Structure[3] Adjustment Existing (VdB)	Propagation Geology[4] Adjustment Existing (VdB)	Wood Frame Structure (VdB)	Masonry Structure (VdB)	1-5 Floors Above Grade (VdB)	Floor Amplifi-cation (VdB)	Average Track Speed - Predicted Build (mph)	Speed Adjustment - Predicted Build (VdB)	Vehicle[2] Condition - Existing (VdB)	Elevated Structure[3] Adjustment - Predicted Build (VdB)	Propagation Geology[4] Adjustment Existing (VdB)	Wood Frame Structure (VdB)	Masonry Structure (VdB)	1-5 Floors Above Grade (VdB)	Floor Amplifi-cation (VdB)	Predicted Existing Vibration (VdB)	Predicted Build Vibration (VdB)
WA7-R-23	85	85	29	-5	0	-5	10	-5		-2	6	27	-5	0	-5	10	-5		-2	6	84	84
WA7-R-24	82	82	29	-5	0	-5	10		-7	-2	6	27	-5	0	-5	10		-7	-2	6	79	79

Notes:

[1] Highest Vibration Level, from the Generalized Vibration Curve (Figure 10-1), of either the Southbound (Track 1) or Northbound (Track 2) at each receptor.

[2] Worn wheel adjustment made for Freight Rail Car. For locomotives assume no worn wheel adjustment

[3] Existing and proposed tracks are elevated structure/embankment, because both the existing and proposed tracks would be at least 1 feet higher than the base elevation at all receptors

[4] Existing and proposed geological conditions assumed to have "efficient" vibration propagation.

The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing moved existing tracks. When analyzing moved existing tracks, the "Predicted Build" considers the total number of trains using those tracks in the design year to determine the frequency category (frequent, occasional or infrequent) and impact level in Table 7-1, as well as the vibration level.

Vibration General Assessment Report Form For
Vibration Impact Summary
CREATE Project WA7

Heavily Used Rail Corridor (existing train volume >12 trains/day)
Commuter Locomotives

Ground-borne Vibration (GBV) Impacts													
1	2	3	4	occasional	6	7	8	9	10	11	12	13	14
Receptors	FTA [2] Vibration Land Use Category	Existing Vibration Frequency event [1]	Existing FTA Vibration Impact Criteria [3] (VdB)	Predicted Build Vibration Frequency event [1]	Predicted Build FTA Vibration Impact Criteria [3] (VdB)	Predicted Existing Vibration (VdB)	Predicted Build Vibration (VdB)	Difference between Predicted Existing Vibration and Predicted Build Vibration (VdB)	Does Predicted Existing Vibration equal or exceed the FTA impact criteria in Column 4? If Yes, go to Column 11. If No, go to Column 13.	Does the ratio of Build Train Events to Existing Train Events equal or exceed 2? If Yes, go to Column 14 and indicate "Yes." If No, go to column 12 [4]	Does the Predicted Build vibration exceed the Predicted Existing vibration by 3 VdB or Greater? If Yes, go to Column 14 and indicate "Yes" - there is a Potential Impact. If No, go to Column 14 and indicate "No" - there is No Potential Impact. [4]	Does Predicted Build Ground-borne Vibration equal or exceed the FTA impact criteria in Column 6? If Yes, go to Column 14 and indicate "Yes" - there is a Potential Impact. If No, go to Column 14 and indicate "No" - there is No Potential Impact. [4]	Potential impact? If Yes, proceed to Detailed Analysis if mitigation measures are viable.
WA7-R-23	2	infrequent	80	infrequent	80	84	84	0	Yes	No	No	NA	No
WA7-R-24	2	infrequent	80	infrequent	80	79	79	0	No	NA	NA	No	No

Notes:

[1] Determine if event is frequent; occasional or infrequent event. Refer to Table 7-1 for definition.

[2] FTA Vibration Land Use Category #2 includes residences and other buildings where people normally sleep, and Category Land Use #3 includes institutional land uses with primarily daytime uses, such as schools and churches.

[3] Source Table 7-1

[4] See Source Calculations for existing and build volumes and refer to Section 7.2.2 item #3

NA = Not applicable

The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing moved existing tracks. When analyzing moved existing tracks, the "Predicted Build" considers the total number of trains using those tracks in the design year to determine the frequency category (frequent, occasional or infrequent) and impact level in Table 7-1, as well as the vibration level.

Vibration General Assessment Report Form For
GBN Impact Summary
CREATE Project WA7

Heavily Used Rail Corridor (existing train volume >12 trains/day)
Commuter Locomotives

Ground-borne Noise (GBN) Impacts

1	2	3	4	occasional	6	7	8	9	10	11	12	13	14
Receptors	FTA [2] Vibration Land Use Category	Existing GBN Frequency event [1]	Existing-FTA GBN Impact Criteria [3] (dBA)	Predicted Build GBN Frequency event [1]	Predicted Build FTA GBN Impact Criteria [3] (dBA)	Predicted Existing GBN (dBA) [5]	Predicted Build GBN (dBA) [5]	Difference between Predicted Existing GBN and Predicted Build GBN (dBA)	Does the Predicted Existing GBN equal or exceed the FTA impact criteria in Column 4? If Yes, go to Column 11. If No, go to Column 13.	Does the ratio of Predicted Build train impact events to Existing equal or exceed 2? If Yes, go to Column 14 and indicate "Yes." If no, go to column 12 [4]	Does the Predicted Build GBN exceed the Predicted Existing GBN by 3 dBA or greater? If yes, go to Column 14 and indicate "Yes" - there is a Potential Impact. If No, go to Column 14 and indicate "No" - there is No Potential Impact. [4]	Does Predicted Build GBN equal or exceed the FTA impact criteria in Column 6? If Yes, go to Column 14 and indicate "Yes" - there is a Potential Impact. If No, go to Column 14 and indicate "No" - there is No Potential Impact. [4]	Potential Impact? If Yes, proceed to Detailed Analysis if mitigation measures are viable.
WA7-R-23	2	infrequent	43	infrequent	43	34	34	0	No	NA	NA	No	No
WA7-R-24	2	infrequent	43	infrequent	43	29	29	0	No	NA	NA	No	No

Notes:

[1] Determine if event is frequent; occasional or infrequent event. Refer to Table 7-1 for definition.

[2] FTA Vibration Land Use Category #2 includes residences and other buildings where people normally sleep, and Category Land Use #3 includes institutional land uses with primarily daytime uses, such as schools and churches.

[3] Source Table 7-1

[4] See Source Calculations for existing and build volumes and refer to Section 7.2.2 item #3

[5] Assumes adjustment of -50 dBA for low frequency vibration sources (FTA Manual Table 10-1).

NA = Not applicable

The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing moved existing tracks. When analyzing moved existing tracks, the "Predicted Build" considers the total number of trains using those tracks in the design year to determine the frequency category (frequent, occasional or infrequent) and impact level in Table 7-1, as well as the vibration level.

NA = Not applicable
The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing

Vibration General Assessment Report Form For Source Calculations:
CREATE Project WA7

Heavily Used Rail Corridor (existing train volume >12 trains/day)
Freight Locomotives

Receptors	Peak Day Existing Volumes	Peak Day Predicted Build Volumes	Existing Impact Frequency Category [1]	Predicted Build Impact Frequency Category [1]	Distance[2] Existing Track 1 (feet)	Distance[2] Existing Track 2 (feet)	Distance[2] Proposed Track 1 (feet)	Distance[1] Proposed Track 2 (feet)	Generalized Vibration Curve[3] Existing Track 1 (VdB)	Generalized Vibration Curve[3] Existing Track 2 (VdB)	Generalized Vibration Curve[3] Proposed Track 1 (VdB)	Generalized Vibration Curve[3] Proposed Track 2 (VdB)	Highest[4] Predicted Existing Vibration Level at Each Receptor (VdB)	Highest[4] Predicted Build Vibration Level at Each Receptor (VdB)
WA7-R-25	66	76	occasional	frequent	75	135	28	135	81	75	89	75	81	89
WA7-R-26	66	76	occasional	frequent	186	298	80	312	73	71	80	71	73	80
WA7-R-35	66	76	occasional	frequent	158	171	158	171	74	73	74	73	74	74
WA7-R-39	66	76	occasional	frequent	82	95	82	95	80	79	80	79	80	80
WA7-R-47	66	76	occasional	frequent	131	144	131	144	75	74	75	74	75	75
WA7-C-02	54	68	occasional	occasional	155	169	96	131	74	73	78	75	74	78
WA7-S-02	54	68	occasional	occasional	141	155	141	155	74	74	74	74	74	74
WA7-R-50	54	68	occasional	occasional	57	70	57	70	83	81	83	81	83	83
WA7-R-52	54	68	occasional	occasional	70	83	70	83	81	80	81	80	81	81
WA7-S-03	54	68	occasional	occasional	94	107	94	107	79	78	79	78	79	79

Notes:

[1] Determine if event is frequent; occasional or infrequent event. Refer to Table 7-1 for definition.

[2] Distances measured from centerlines of existing and proposed tracks to faces of buildings.

[3] Generalized Ground Surface Vibration Curve (Figure 10-1) for locomotive-powered passenger or freight trains at 50 mph.

[4] Highest vibration level, from the Generalized Vibration Curve (Figure 10-1), of either Track 1 or Track 2 at each receptor. The example project assumes the same adjustments are applied to both tracks. If the same adjustments cannot be applied to all tracks, the analyst may have to apply adjustments to the tracks individually to determine the highest predicted vibration at each receptor.

The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing moved existing tracks. When analyzing moved existing tracks, the "Predicted Build" considers the total number of trains using those tracks in the design year to determine the frequency category (frequent, occasional or infrequent) and impact level in Table 7-1, as well as the vibration level.

Vibration General Assessment Report Form For **Heavily Used Rail Corridor (existing train volume >12 trains/day)**
Vibration Adjustment Factors **Freight Locomotives**
CREATE Project WA7

	Unadjusted		Existing Adjustments									Predicted Build Adjustments									Adjusted	
			Speed Adjustments		Source Adjustments		Path Adjustments			Receiver Adjustments		Speed Adjustments		Source Adjustments		Path Adjustments			Receiver Adjustments			
Receptors	Highest[1] Vibration Level @ 50 mph at Each Receptor Existing (VdB)	Highest[1] Vibration Level @ 50 mph at Each Receptor Predicted Build (VdB)	Average Track Speed - Existing (mph)	Speed Adjustment Existing (VdB)	Vehicle[2] Condition - Existing (VdB)	Elevated Structure[3] Adjustment Existing (VdB)	Propagation Geology[4] Adjustment Existing (VdB)	Wood Frame Structure (VdB)	Masonry Structure (VdB)	1-5 Floors Above Grade (VdB)	Floor Amplifi-cation (VdB)	Average Track Speed - Predicted Build (mph)	Speed Adjustment - Predicted Build (VdB)	Vehicle[2] Condition - Existing (VdB)	Elevated Structure[3] Adjustment - Predicted Build (VdB)	Propagation Geology[4] Adjustment Existing (VdB)	Wood Frame Structure (VdB)	Masonry Structure (VdB)	1-5 Floors Above Grade (VdB)	Floor Amplifi-cation (VdB)	Predicted Existing Vibration (VdB)	Predicted Build Vibration (VdB)
WA7-R-25	81	89	10	-14	0	-5	10		-7	-2	6	14	-11	0	-5	10		-7	-2	6	69	80
WA7-R-26	73	80	10	-14	0	-5	10		-7	-2	6	14	-11	0	-5	10		-7	-2	6	61	71
WA7-R-35	74	74	14	-11	0	-5	10		-7	-2	6	23	-7	0	-5	10		-7	-2	6	65	69
WA7-R-39	80	80	14	-11	0	-5	10	-5		-2	6	23	-7	0	-5	10	-5		-2	6	73	77
WA7-R-47	75	75	14	-11	0	-5	10		-7	-2	6	23	-7	0	-5	10		-7	-2	6	66	70
WA7-C-02	74	78	14	-11	0	-5	10		-7			9	-15	0	-5	10		-7			61	61
WA7-S-02	74	74	14	-11	0	-5	10		-7			22	-7	0	-5	10		-7			61	65
WA7-R-50	83	83	14	-11	0	-5	10	-5		-2	6	22	-7	0	-5	10	-5		-2	6	76	80
WA7-R-52	81	81	14	-11	0	-5	10	-5		-2	6	22	-7	0	-5	10	-5		-2	6	74	78
WA7-S-03	79	79	14	-11	0	-5	10		-7			22	-7	0	-5	10		-7			66	70

Notes:

[1] Highest Vibration Level, from the Generalized Vibration Curve (Figure 10-1), of either the Southbound (Track 1) or Northbound (Track 2) at each receptor.

[2] Worn wheel adjustment made for Freight Rail Car. For locomotives assume no worn wheel adjustment

[3] Existing and proposed tracks are elevated structure/embankment, because both the existing and proposed tracks would be at least 1 feet higher than the base elevation at all receptors

[4] Existing and proposed geological conditions assumed to have "efficient" vibration propagation.

The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing moved existing tracks. When analyzing moved existing tracks, the "Predicted Build" considers the total number of trains using those tracks in the design year to determine the frequency category (frequent, occasional or infrequent) and impact level in Table 7-1, as well as the vibration level.

Vibration General Assessment Report Form For
Vibration Impact Summary
CREATE Project WA7

Heavily Used Rail Corridor (existing train volume >12 trains/day)
Freight Locomotives

Ground-borne Vibration (GBV) Impacts													
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Receptors	FTA [2] Vibration Land Use Category	Existing Vibration Frequency event [1]	Existing FTA Vibration Impact Criteria [3] (VdB)	Predicted Build Vibration Frequency event [1]	Predicted Build FTA Vibration Impact Criteria [3] (VdB)	Predicted Existing Vibration (VdB)	Predicted Build Vibration (VdB)	Difference between Predicted Existing Vibration and Predicted Build Vibration (VdB)	Does Predicted Existing Vibration equal or exceed the FTA impact criteria in Column 4? If Yes, go to Column 11. If No, go to Column 13.	Does the ratio of Build Train Events to Existing Train Events equal or exceed 2? If Yes, go to Column 14 and indicate "Yes." If No, go to column 12 [4]	Does the Predicted Build vibration exceed the Predicted Existing vibration by 3 VdB or Greater? If Yes, go to Column 14 and indicate "Yes" - there is a Potential Impact. If No, go to Column 14 and indicate "No" - there is No Potential Impact. [4]	Does Predicted Build Ground-borne Vibration equal or exceed the FTA impact criteria in Column 6? If Yes, go to Column 14 and indicate "Yes" - there is a Potential Impact. If No, go to Column 14 and indicate "No" - there is No Potential Impact. [4]	Potential impact? If Yes, proceed to Detailed Analysis if mitigation measures are viable.
WA7-R-25	2	occasional	75	frequent	72	69	80	11	No	NA	NA	Yes	Yes
WA7-R-26	2	occasional	75	frequent	72	61	71	10	No	NA	NA	No	No
WA7-R-35	2	occasional	75	frequent	72	65	69	4	No	NA	NA	No	No
WA7-R-39	2	occasional	75	frequent	72	73	77	4	No	NA	NA	Yes	Yes
WA7-R-47	2	occasional	75	frequent	72	66	70	4	No	NA	NA	No	No
WA7-C-02	2	occasional	75	occasional	75	61	61	0	No	NA	NA	No	No
WA7-S-02	3	occasional	78	occasional	78	61	65	4	No	NA	NA	No	No
WA7-R-50	2	occasional	75	occasional	75	76	80	4	Yes	No	Yes	NA	Yes
WA7-R-52	2	occasional	75	occasional	75	74	78	4	No	NA	NA	Yes	Yes
WA7-S-03	3	occasional	78	occasional	78	66	70	4	No	NA	NA	No	No

Notes:

[1] Determine if event is frequent; occasional or infrequent event. Refer to Table 7-1 for definition.

[2] FTA Vibration Land Use Category #2 includes residences and other buildings where people normally sleep, and Category Land Use #3 includes institutional land uses with primarily daytime uses, such as schools and churches.

[3] Source Table 7-1

[4] See Source Calculations for existing and build volumes and refer to Section 7.2.2 item #3

NA = Not applicable

The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing moved existing tracks. When analyzing moved existing tracks, the "Predicted Build" considers the total number of trains using those tracks in the design year to determine the frequency category (frequent, occasional or infrequent) and impact level in Table 7-1, as well as the vibration level.

Vibration General Assessment Report Form For
GBN Impact Summary
CREATE Project WA7

Heavily Used Rail Corridor (existing train volume >12 trains/day)
Freight Locomotives

Ground-borne Noise (GBN) Impacts

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Receptors	FTA [2] Vibration Land Use Category	Existing GBN Frequency event [1]	Existing-FTA GBN Impact Criteria [3] (dBA)	Predicted Build GBN Frequency event [1]	Predicted Build FTA GBN Impact Criteria [3] (dBA)	Predicted Existing GBN (dBA) [5]	Predicted Build GBN (dBA) [5]	Difference between Predicted Existing GBN and Predicted Build GBN (dBA)	Does the Predicted Existing GBN equal or exceed the FTA impact criteria in Column 4? If Yes, go to Column 11. If No, go to Column 13.	Does the ratio of Predicted Build train impact events to Existing equal or exceed 2? If Yes, go to Column 14 and indicate "Yes." If no, go to column 12 [4]	Does the Predicted Build GBN exceed the Predicted Existing GBN by 3 dBA or greater? If yes, go to Column 14 and indicate "Yes" - there is a Potential Impact. If No, go to Column 14 and indicate "No" - there is No Potential Impact. [4]	Does Predicted Build GBN equal or exceed the FTA impact criteria in Column 6? If Yes, go to Column 14 and indicate "Yes" - there is a Potential Impact. If No, go to Column 14 and indicate "No" - there is No Potential Impact. [4]	Potential Impact? If Yes, proceed to Detailed Analysis if mitigation measures are viable.
WA7-R-25	2	occasional	38	frequent	35	19	30	11	No	NA	NA	No	No
WA7-R-26	2	occasional	38	frequent	35	11	21	10	No	NA	NA	No	No
WA7-R-35	2	occasional	38	frequent	35	15	19	4	No	NA	NA	No	No
WA7-R-39	2	occasional	38	frequent	35	23	27	4	No	NA	NA	No	No
WA7-R-47	2	occasional	38	frequent	35	16	20	4	No	NA	NA	No	No
WA7-C-02	2	occasional	38	occasional	38	11	11	0	No	NA	NA	No	No
WA7-S-02	3	occasional	43	occasional	43	11	15	4	No	NA	NA	No	No
WA7-R-50	2	occasional	38	occasional	38	26	30	4	No	NA	NA	No	No
WA7-R-52	2	occasional	38	occasional	38	24	28	4	No	NA	NA	No	No
WA7-S-03	3	occasional	43	occasional	43	16	20	4	No	NA	NA	No	No

Notes:

[1] Determine if event is frequent; occasional or infrequent event. Refer to Table 7-1 for definition.

[2] FTA Vibration Land Use Category #2 includes residences and other buildings where people normally sleep, and Category Land Use #3 includes institutional land uses with primarily daytime uses, such as schools and churches.

[3] Source Table 7-1

[4] See Source Calculations for existing and build volumes and refer to Section 7.2.2 item #3

[5] Assumes adjustment of -50 dBA for low frequency vibration sources (FTA Manual Table 10-1).

NA = Not applicable

The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing moved existing tracks. When analyzing moved existing tracks, the "Predicted Build" considers the total number of trains using those tracks in the design year to determine the frequency category (frequent, occasional or infrequent) and impact level in Table 7-1, as well as the vibration level.

Vibration General Assessment Report Form For Source Calculations:
CREATE Project WA7

Heavily Used Rail Corridor (existing train volume >12 trains/day)
Freight Rail Car

Receptors	Peak Day Existing Volumes	Peak Day Predicted Build Volumes	Existing Impact Frequency Category [1]	Build Impact Frequency Category [1]	Distance[2] Existing Track 1 (feet)	Distance[2] Existing Track 2 (feet)	Distance[2] Proposed Track 1 (feet)	Distance[1] Proposed Track 2 (feet)	Generalized Vibration Curve[3] Existing Track 1 (VdB)	Generalized Vibration Curve[3] Existing Track 2 (VdB)	Generalized Vibration Curve[3] Proposed Track 1 (VdB)	Generalized Vibration Curve[3] Proposed Track 2 (VdB)	Highest[4] Predicted Existing Vibration Level at Each Receptor (VdB)	Highest[4] Predicted Build Vibration Level at Each Receptor (VdB)
WA7-R-25	66	76	frequent	frequent	75	135	28	135	70	64	77	64	70	77
WA7-R-26	66	76	frequent	frequent	186	298	80	312	61	60	69	60	61	69
WA7-R-35	66	76	frequent	frequent	158	171	158	171	63	62	63	62	63	63
WA7-R-39	66	76	frequent	frequent	82	95	82	95	69	67	69	67	69	69
WA7-R-47	66	76	frequent	frequent	131	144	131	144	64	64	64	64	64	64
WA7-C-02	54	68	frequent	frequent	155	169	96	131	63	62	67	64	63	67
WA7-S-02	54	68	frequent	frequent	141	155	141	155	64	63	64	63	64	64
WA7-R-50	54	68	frequent	frequent	57	70	57	70	72	70	72	70	72	72
WA7-R-52	54	68	frequent	frequent	70	83	70	83	70	69	70	69	70	70
WA7-S-03	54	68	frequent	frequent	94	107	94	107	67	66	67	66	67	67

Notes:

[1] Determine if event is frequent; occasional or infrequent event. Refer to Table 7-1 for definition.

[2] Distances measured from centerlines of existing and proposed tracks to faces of buildings.

[3] Generalized Ground Surface Vibration Curve (Figure 10-1) for rapid transit or light rail vehicles at 50 mph.

[4] Highest vibration level, from the Generalized Vibration Curve (Figure 10-1), of either Track 1 or Track 2 at each receptor. The example project assumes the same adjustments are applied to both tracks. If the same adjustments cannot be applied to all tracks, the analyst may have to apply adjustments to the tracks individually to determine the highest predicted vibration at each receptor.

The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing moved existing tracks. When analyzing moved existing tracks, the "Predicted Build" considers the total number of trains using those tracks in the design year to determine the frequency category (frequent, occasional or infrequent) and impact level in Table 7-1, as well as the vibration level.

Vibration General Assessment Report Form For **Heavily Used Rail Corridor (existing train volume >12 trains/day)**
Vibration Adjustment Factors **Freight Rail Car**
CREATE Project WA7

	Unadjusted		Existing Adjustments									Predicted Build Adjustments									Adjusted	
			Speed Adjustments		Source Adjustments		Path Adjustments			Receiver Adjustments		Speed Adjustments		Source Adjustments		Path Adjustments			Receiver Adjustments			
Receptors	Highest[1] Vibration Level @ 50 mph at Each Receptor Existing (VdB)	Highest[1] Vibration Level @ 50 mph at Each Receptor Predicted Build (VdB)	Average Track Speed - Existing (mph)	Speed Adjustment - Existing (VdB)	Vehicle[2] Condition Existing (VdB)	Elevated Structure[3] Adjustment Existing (VdB)	Propagation Geology[4] Adjustment Existing (VdB)	Wood Frame Structure (VdB)	Masonry Structure (VdB)	1-5 Floors Above Grade (VdB)	Floor Amplifi-cation (VdB)	Average Track Speed - Predicted Build (mph)	Speed Adjustment - Predicted Build (VdB)	Vehicle[2] Condition Existing (VdB)	Elevated Structure[3] Adjustment - Predicted Build (VdB)	Propagation Geology[4] Adjustment Existing (VdB)	Wood Frame Structure (VdB)	Masonry Structure (VdB)	1-5 Floors Above Grade (VdB)	Floor Amplifi-cation (VdB)	Predicted Existing Vibration (VdB)	Predicted Build Vibration (VdB)
WA7-R-25	70	77	10	-14	10	-5	10	0	-7	-2	6	14	-11	10	-5	10	0	-7	-2	6	68	78
WA7-R-26	61	69	10	-14	10	-5	10	0	-7	-2	6	14	-11	10	-5	10	0	-7	-2	6	59	70
WA7-R-35	63	63	14	-11	10	-5	10	0	-7	-2	6	23	-7	10	-5	10	0	-7	-2	6	64	68
WA7-R-39	69	69	14	-11	10	-5	10	-5	0	-2	6	23	-7	10	-5	10	-5	0	-2	6	72	76
WA7-R-47	64	64	14	-11	10	-5	10	0	-7	-2	6	23	-7	10	-5	10	0	-7	-2	6	65	69
WA7-C-02	63	67	14	-11	10	-5	10	0	-7	0	0	9	-15	10	-5	10	0	-7	0	0	60	60
WA7-S-02	64	64	14	-11	10	-5	10	0	-7	0	0	22	-7	10	-5	10	0	-7	0	0	61	65
WA7-R-50	72	72	14	-11	10	-5	10	-5	0	-2	6	22	-7	10	-5	10	-5	0	-2	6	75	79
WA7-R-52	70	70	14	-11	10	-5	10	-5	0	-2	6	22	-7	10	-5	10	-5	0	-2	6	73	77
WA7-S-03	67	67	14	-11	10	-5	10	0	-7	0	0	22	-7	10	-5	10	0	-7	0	0	64	68

Notes:

[1] Highest Vibration Level, from the Generalized Vibration Curve (Figure 10-1), of either the Southbound (Track 1) or Northbound (Track 2) at each receptor

[2] Worn wheel adjustment made for Freight Rail Car. For locomotives assume no worn wheel adjustment

[3] Existing and proposed tracks are elevated structure/embankment, because both the existing and proposed tracks would be at least 1 feet higher than the base elevation at all receptor

[4] Existing and proposed geological conditions assumed to have "efficient" vibration propagation.

The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing moved existing tracks. When analyzing moved existing tracks, the "Predicted Build" considers the total number of trains using those tracks in the design year to determine the frequency category (frequent, occasional or infrequent) and impact level in Table 7-1, as well as the vibration level.

Vibration General Assessment Report Form For
Vibration Impact Summary
CREATE Project WA7

Heavily Used Rail Corridor (existing train volume >12 trains/day)
Freight Rail Car

Ground-borne Vibration (GBV) Impacts													
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Receptors	FTA [2] Vibration Land Use Category	Existing Vibration Frequency event [1]	Existing-FTA Vibration Impact Criteria [3] (VdB)	Predicted Build Vibration Frequency event [1]	Proposed FTA Vibration Impact Criteria [3] (VdB)	Predicted Existing Vibration (VdB)	Predicted Build Vibration (VdB)	Difference between Predicted Existing vibration and Predicted Build vibration (VdB)	Does the Predicted Existing vibration equal or exceed the FTA impact criteria in Column 4? If Yes, go to Column 11. If No, go to Column 13.	Does the ratio of Predicted Build train impact events to Existing equal or exceed 2? If Yes, go to Column 14 and indicate "Yes". If No, go to column 12 [4]	Does the Predicted Build vibration exceed the Predicted Existing vibration by 3 VdB or greater? If Yes, go to Column 14 and indicate "Yes" - there is a Potential Impact. If No, go to Column 14 and indicate "No" - there is No Potential Impact. [4]	Does the Predicted Build vibration equal or exceed the FTA impact criteria in Column 6? If Yes, go to Column 14 and indicate "Yes" - there is a Potential Impact. If No, go to Column 14 and indicate "No" - there is No Potential Impact. [4]	Potential Impact? If Yes, proceed to Detailed Analysis if mitigation measures are viable.
WA7-R-25	2	frequent	72	frequent	72	68	78	10	No	NA	NA	Yes	Yes
WA7-R-26	2	frequent	72	frequent	72	59	70	11	No	NA	NA	No	No
WA7-R-35	2	frequent	72	frequent	72	64	68	4	No	NA	NA	No	No
WA7-R-39	2	frequent	72	frequent	72	72	76	4	Yes	No	Yes	NA	Yes
WA7-R-47	2	frequent	72	frequent	72	65	69	4	No	NA	NA	No	No
WA7-C-02	2	frequent	72	frequent	72	60	60	0	No	NA	NA	No	No
WA7-S-02	3	frequent	75	frequent	75	61	65	4	No	NA	NA	No	No
WA7-R-50	2	frequent	72	frequent	72	75	79	4	Yes	No	Yes	NA	Yes
WA7-R-52	2	frequent	72	frequent	72	73	77	4	Yes	No	Yes	NA	Yes
WA7-S-03	3	frequent	75	frequent	75	64	68	4	No	NA	NA	No	No

Notes:

[1] Determine if event is frequent; occasional or infrequent event. Refer to Table Table 7-1 for definition

[2] FTA Vibration Land Use Category #2 includes residences and other buildings where people normally sleep, and Category Land Use #3 includes institutional land uses with primarily daytime uses, such as schools and churches.

[3] Source Table 7-1

[4] See Source Calculations for existing and build volumes and refer to Section 7.2.2 item #3

NA = Not applicable

The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing moved existing tracks. When analyzing moved existing tracks, the "Predicted Build" considers the total number of trains using those tracks in the design year to determine the frequency category (frequent, occasional or infrequent) and impact level in Table 7-1, as well as the vibration level.

Vibration General Assessment Report Form For
GBN Impact Summary
CREATE Project WA7

Heavily Used Rail Corridor (existing train volume >12 trains/day)
Freight Rail Car

Ground-borne Noise (GBN) Impacts

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Receptors	FTA [2] Vibration Land Use Category	Existing GBN Frequency event [1]	Existing-FTA GBN Impact Criteria [3] (dBA)	Predicted Build GBN Frequency event [1]	Proposed FTA GBN Impact Criteria [3] (dBA)	Predicted Existing GBN (dBA) [5]	Predicted Build GBN (dBA) [5]	Difference between Predicted Existing GBN and Predicted Build GBN (dBA)	Does the Predicted Existing GBN equal or exceed the FTA impact criteria in Column 4? If Yes, go to Column 11. If No, go to Column 13.	Does the ratio of Predicted Build train impact events to Existing equal or exceed 2? If Yes, go to Column 14 and indicate "Yes." If No, go to column 12. [4]	Does the Predicted Build GBN exceed the Predicted Existing GBN by 3 dBA or greater? If Yes, go to Column 14 and indicate "Yes" - there is a Potential Impact. If No, go to Column 14 and indicate "No" - there is No Potential Impact. [4]	Does the Predicted Build GBN equal or exceed the FTA impact criteria in Column 6? If Yes, go to Column 14 and indicate "Yes" - there is a Potential Impact. If No, go to Column 14 and indicate "No" - there is No Potential Impact. [4]	Potential Impact? If Yes, proceed to Detailed Analysis if mitigation measures are viable.
WA7-R-25	2	frequent	35	frequent	35	18	28	10	No	NA	NA	No	No
WA7-R-26	2	frequent	35	frequent	35	9	20	11	No	NA	NA	No	No
WA7-R-35	2	frequent	35	frequent	35	14	18	4	No	NA	NA	No	No
WA7-R-39	2	frequent	35	frequent	35	22	26	4	No	NA	NA	No	No
WA7-R-47	2	frequent	35	frequent	35	15	19	4	No	NA	NA	No	No
WA7-C-02	2	frequent	35	frequent	35	10	10	0	No	NA	NA	No	No
WA7-S-02	3	frequent	40	frequent	40	11	15	4	No	NA	NA	No	No
WA7-R-50	2	frequent	35	frequent	35	25	29	4	No	NA	NA	No	No
WA7-R-52	2	frequent	35	frequent	35	23	27	4	No	NA	NA	No	No
WA7-S-03	3	frequent	40	frequent	40	14	18	4	No	NA	NA	No	No

Notes:

[1] Determine if event is frequent; occasional or infrequent event. Refer to Table 7-1 for definition.

[2] FTA Vibration Land Use Category #2 includes residences and other buildings where people normally sleep, and Category Land Use #3 includes institutional land uses with primarily daytime uses, such as schools and churches.

[3] Source Table 7-1

[4] See Source Calculations for existing and build volumes and refer to Section 7.2.2 item #3

[5] Assumes adjustment of -50 dB for low frequency vibration sources (FTA Manual Table 10-1).

NA = Not applicable

The "Predicted Build" is the same as the "Build Scenario CREATE Program Train Vibration Level (Design Year)" as referenced in the Noise and Vibration Methodology Section 7.2.2 except when analyzing moved existing tracks. When analyzing moved existing tracks, the "Predicted Build" considers the total number of trains using those tracks in the design year to determine the frequency category (frequent, occasional or infrequent) and impact level in Table 7-1, as well as the vibration level.

Vibration General Assessment Report Form For Source Calculations:
CREATE Project WA7

No Build Alternative
Freight Locomotives

Receptors	Peak Day No-Build Volumes	No-Build Frequency Category [1]	Distance[2] Existing Track 1 (feet)	Distance[2] Existing Track 2 (feet)	Generalized Vibration Curve[3] Existing Track 1 (VdB)	Generalized Vibration Curve[3] Existing Track 2 (VdB)	Highest[4] No-Build Vibration Level at Each Receptor (VdB)
WA7-R-23	1	infrequent	43	56	85	83	85
WA7-R-24	1	infrequent	66	79	82	80	82

Notes:

[1] Determine if event is frequent; occasional or infrequent event. Refer to Table 7-1 for definition.

[2] Distances measured from centerlines of existing tracks to faces of buildings.

[3] Generalized Ground Surface Vibration Curve (Figure 10-1) for locomotive-powered passenger or freight trains at 50 mph.

[4] Highest vibration level, from the Generalized Vibration Curve (Figure 10-1), of either Track 1 or Track 2 at each receptor. The example project assumes the same adjustments are applied to both tracks. If the same adjustments cannot be applied to all tracks, the analyst may have to apply adjustments to the tracks individually to determine the highest predicted vibration at each receptor.

The "Predicted No-Build" is the "No-Build Scenario CREATE Program Train Vibration Level (Design Year)" which includes all train vibration from no-build scenario (design year) trains operating on tracks affected by the CREATE Program.

Vibration General Assessment Report Form For **No Build Alternative**
Vibration Adjustment Factors **Freight Locomotives**
CREATE Project WA7

	Unadjusted	No Build Adjustments									Adjusted	
	Speed Adjustments			Source Adjustments		Path Adjustments			Receiver Adjustments			
Receptors	Highest[1] Vibration Level @ 50 mph at Each Receptor No-Build (VdB)	Average Track Speed - No-Build (mph)	Speed Adjustment No-Build (VdB)	Vehicle[2] Condition Existing (VdB)	Elevated Structure[3] Adjustment Existing (VdB)	Propagation Geology[4] Adjustment Existing (VdB)	Wood Frame Structure (VdB)	Masonry Structure (VdB)	1-5 Floors Above Grade (VdB)	Floor Amplifi-cation (VdB)	No-Build Vibration (VdB)	No-Build GBN (dBA)
WA7-R-23	85	9	-15	0	-5	10	-5	0	-2	6	74	24
WA7-R-24	82	9	-15	0	-5	10	0	-7	-2	6	69	19

Notes:

(1) Highest Vibration Level, from the Generalized Vibration Curve (Figure 10-1), of either the Southbound (Track 1) or Northbound (Track 2) at each receptor.

(2) For locomotives assume no worn wheel adjustment

(3) The existing tracks are on elevated structure/embankment (they are at least 1 feet higher than the base elevation at all receptors).

(4) Existing geological conditions assumed to have "efficient" vibration propagation.

The "Predicted No-Build" is the "No-Build Scenario CREATE Program Train Vibration Level (Design Year)" which includes all train vibration from no-build scenario (design year) trains operating on tracks affected by the CREATE Program.

Vibration General Assessment Report Form For Source Calculations:
CREATE Project WA7

No Build Alternative
Freight Rail Car

Receptors	Peak Day No-Build Volumes	No-Build Frequency Category [1]	Distance[2] Existing Track 1 (feet)	Distance[2] Existing Track 2 (feet)	Generalized Vibration Curve[3] Existing Track 1 (VdB)	Generalized Vibration Curve[3] Existing Track 2 (VdB)	Highest[4] No-Build Vibration Level at Each Receptor (VdB)
WA7-R-23	1	frequent	43	56	74	72	74
WA7-R-24	1	frequent	66	79	71	69	71

Notes:

[1] Determine if event is frequent; occasional or infrequent event. Refer to Table 7-1 for definition.

[2] Distances measured from centerlines of existing tracks to faces of buildings.

[3] Generalized Ground Surface Vibration Curve (Figure 10-1) for rapid transit or light rail vehicles at 50 mph.

[4] Highest vibration level, from the Generalized Vibration Curve (Figure 10-1), of either Track 1 or Track 2 at each receptor. The example project assumes the same adjustments are applied to both tracks. If the same adjustments cannot be applied to all tracks, the analyst may have to apply adjustments to the tracks individually to determine the highest predicted vibration at each receptor.

The "Predicted No-Build" is the "No-Build Scenario CREATE Program Train Vibration Level (Design Year)" which includes all train vibration from no-build scenario (design year) trains operating on tracks affected by the CREATE Program.

Vibration General Assessment Report Form For **No Build Alternative**
Vibration Adjustment Factors **Freight Rail Car**
CREATE Project WA7

	Unadjusted	No Build Adjustments									Adjusted	
	Speed Adjustments			Source Adjustments		Path Adjustments			Receiver Adjustments			
Receptors	Highest[1] Vibration Level @ 50 mph at Each Receptor No-Build (VdB)	Average Track Speed - No-Build (mph)	Speed Adjustment No-Build (VdB)	Vehicle[2] Condition Existing (VdB)	Elevated Structure[3] Adjustment Existing (VdB)	Propagation Geology[4] Adjustment Existing (VdB)	Wood Frame Structure (VdB)	Masonry Structure (VdB)	1-5 Floors Above Grade (VdB)	Floor Amplifi-cation (VdB)	No-Build Vibration (VdB)	No-Build GBN (dBA)
WA7-R-23	74	9	-15	10	-5	10	-5	0	-2	6	73	23
WA7-R-24	71	9	-15	10	-5	10	0	-7	-2	6	68	18

Notes:

(1) Highest Vibration Level, from the Generalized Vibration Curve (Figure 10-1), of either the Southbound (Track 1) or Northbound (Track 2) at each receptor.

(2) Worn wheel adjustment made for Freight Rail Car. For locomotives assume no worn wheel adjustment

(3) The existing tracks are on elevated structure/embankment (they are at least 1 feet higher than the base elevation at all receptors).

(4) Existing geological conditions assumed to have "efficient" vibration propagation.

The "Predicted No-Build" is the "No-Build Scenario CREATE Program Train Vibration Level (Design Year)" which includes all train vibration from no-build scenario (design year) trains operating on tracks affected by the CREATE Program.

Vibration General Assessment Report Form For Source Calculations:
CREATE Project WA7

No Build Alternative
Commuter Locomotives

Receptors	Peak Day No-Build Volumes	No-Build Frequency Category [1]	Distance[2] Existing Track 1 (feet)	Distance[2] Existing Track 2 (feet)	Generalized Vibration Curve[3] Existing Track 1 (VdB)	Generalized Vibration Curve[3] Existing Track 2 (VdB)	Highest[4] No-Build Vibration Level at Each Receptor (VdB)
WA7-R-23	20	infrequent	43	56	85	83	85
WA7-R-24	20	infrequent	66	79	82	80	82

Notes:

[1] Determine if event is frequent; occasional or infrequent event. Refer to Table 7-1 for definition.

[2] Distances measured from centerlines of existing tracks to faces of buildings.

[3] Generalized Ground Surface Vibration Curve (Figure 10-1) for locomotive-powered passenger or freight trains at 50 mph.

[4] Highest vibration level, from the Generalized Vibration Curve (Figure 10-1), of either Track 1 or Track 2 at each receptor. The example project assumes the same adjustments are applied to both tracks. If the same adjustments cannot be applied to all tracks, the analyst may have to apply adjustments to the tracks individually to determine the highest predicted vibration at each receptor.

The "Predicted No-Build" is the "No-Build Scenario CREATE Program Train Vibration Level (Design Year)" which includes all train vibration from no-build scenario (design year) trains operating on tracks affected by the CREATE Program.

Vibration General Assessment Report Form For **No Build Alternative**
Vibration Adjustment Factors **Commuter Locomotives**
CREATE Project WA7

	Unadjusted	No Build Adjustments									Adjusted	
		Speed Adjustments		Source Adjustments		Path Adjustments			Receiver Adjustments			
Receptors	Highest[1] Vibration Level @ 50 mph at Each Receptor No-Build (VdB)	Average Track Speed - No-Build (mph)	Speed Adjustment No-Build (VdB)	Vehicle[2] Condition Existing (VdB)	Elevated Structure[3] Adjustment Existing (VdB)	Propagation Geology[4] Adjustment Existing (VdB)	Wood Frame Structure (VdB)	Masonry Structure (VdB)	1-5 Floors Above Grade (VdB)	Floor Amplifi-cation (VdB)	No-Build Vibration (VdB)	No-Build GBN (dBA)
WA7-R-23	85	25	-6	0	-5	10	-5	0	-2	6	83	33
WA7-R-24	82	25	-6	0	-5	10	0	-7	-2	6	78	28

Notes:

[1] Highest Vibration Level, from the Generalized Vibration Curve (Figure 10-1), of either the Southbound (Track 1) or Northbound (Track 2) at each receptor.

[2] For locomotives assume no worn wheel adjustment

[3] The existing tracks are on elevated structure/embankment (they are at least 1 feet higher than the base elevation at all receptors).

[4] Existing geological conditions assumed to have "efficient" vibration propagation

The "Predicted No-Build" is the "No-Build Scenario CREATE Program Train Vibration Level (Design Year)" which includes all train vibration from no-build scenario (design year) trains operating on tracks affected by the CREATE Program.

Vibration General Assessment Report Form For Source Calculations:
CREATE Project WA7

No Build Alternative
Freight Locomotives

Receptors	Peak Day No-Build Volumes	No-Build Frequency Category [1]	Distance[2] Existing Track 1 (feet)	Distance[2] Existing Track 2 (feet)	Generalized Vibration Curve[3] Existing Track 1 (VdB)	Generalized Vibration Curve[3] Existing Track 2 (VdB)	Highest[4] No-Build Vibration Level at Each Receptor (VdB)
WA7-R-25	100	frequent	75	135	81	75	81
WA7-R-26	100	frequent	186	298	73	71	73
WA7-R-35	100	frequent	158	171	74	73	74
WA7-R-39	100	frequent	82	95	80	79	80
WA7-R-47	100	frequent	131	144	75	74	75
WA7-C-02	87	frequent	155	169	74	73	74
WA7-S-02	87	frequent	141	155	74	74	74
WA7-R-50	87	frequent	57	70	83	81	83
WA7-R-52	87	frequent	70	83	81	80	81
WA7-S-03	87	frequent	94	107	79	78	79

Notes:

[1] Determine if event is frequent; occasional or infrequent event. Refer to Table 7-1 for definition.

[2] Distances measured from centerlines of existing tracks to faces of buildings.

[3] Generalized Ground Surface Vibration Curve (Figure 10-1) for locomotive-powered passenger or freight trains at 50 mph.

[4] Highest vibration level, from the Generalized Vibration Curve (Figure 10-1), of either Track 1 or Track 2 at each receptor. The example project assumes the same adjustments are applied to both tracks. If the same adjustments cannot be applied to all tracks, the analyst may have to apply adjustments to the tracks individually to determine the highest predicted vibration at each receptor.

The "Predicted No-Build" is the "No-Build Scenario CREATE Program Train Vibration Level (Design Year)" which includes all train vibration from no-build scenario (design year) trains operating on tracks affected by the CREATE Program.

Vibration General Assessment Report Form For **No Build Alternative**
Vibration Adjustment Factors **Freight Locomotives**
CREATE Project WA7

	Unadjusted	No Build Adjustments									Adjusted	
		Speed Adjustments		Source Adjustments		Path Adjustments			Receiver Adjustments			
Receptors	Highest[1] Vibration Level @ 50 mph at Each Receptor No-Build (VdB)	Average Track Speed - No-Build (mph)	Speed Adjustment No-Build (VdB)	Vehicle[2] Condition Existing (VdB)	Elevated Structure[3] Adjustment Existing (VdB)	Propagation Geology[4] Adjustment Existing (VdB)	Wood Frame Structure (VdB)	Masonry Structure (VdB)	1-5 Floors Above Grade (VdB)	Floor Amplifi-cation (VdB)	No-Build Vibration (VdB)	No-Build GBN (dBA)
WA7-R-25	81	14	-11	0	-5	10	0	-7	-2	6	72	22
WA7-R-26	73	14	-11	0	-5	10	0	-7	-2	6	64	14
WA7-R-35	74	14	-11	0	-5	10	0	-7	-2	6	65	15
WA7-R-39	80	14	-11	0	-5	10	-5	0	-2	6	73	23
WA7-R-47	75	14	-11	0	-5	10	0	-7	-2	6	66	16
WA7-C-02	74	12	-13	0	-5	10	0	-7	0	0	59	9
WA7-S-02	74	13	-12	0	-5	10	0	-7	0	0	60	10
WA7-R-50	83	13	-12	0	-5	10	-5	0	-2	6	75	25
WA7-R-52	81	13	-12	0	-5	10	-5	0	-2	6	73	23
WA7-S-03	79	13	-12	0	-5	10	0	-7	0	0	65	15

Notes:

[1] Highest Vibration Level, from the Generalized Vibration Curve (Figure 10-1), of either the Southbound (Track 1) or Northbound (Track 2) at each receptor.

[2] For locomotives assume no worn wheel adjustment

[3] The existing tracks are on elevated structure/embankment (they are at least 1 feet higher than the base elevation at all receptors).

[4] Existing geological conditions assumed to have "efficient" vibration propagation

The "Predicted No-Build" is the "No-Build Scenario CREATE Program Train Vibration Level (Design Year)" which includes all train vibration from no-build scenario (design year) trains operating on tracks affected by the CREATE Program.

Vibration General Assessment Report Form For Source Calculations:
CREATE Project WA7

No Build Alternative
Freight Rail Car

Receptors	Peak Day No-Build Volumes	No-Build Frequency Category [1]	Distance[2] Existing Track 1 (feet)	Distance[2] Existing Track 2 (feet)	Generalized Vibration Curve[3] Existing Track 1 (VdB)	Generalized Vibration Curve[3] Existing Track 2 (VdB)	Highest[4] No-Build Vibration Level at Each Receptor (VdB)
WA7-R-25	100	frequent	75	135	70	64	70
WA7-R-26	100	frequent	186	298	61	60	61
WA7-R-35	100	frequent	158	171	63	62	63
WA7-R-39	100	frequent	82	95	69	67	69
WA7-R-47	100	frequent	131	144	64	64	64
WA7-C-02	87	frequent	155	169	63	62	63
WA7-S-02	87	frequent	141	155	64	63	64
WA7-R-50	87	frequent	57	70	72	70	72
WA7-R-52	87	frequent	70	83	70	69	70
WA7-S-03	87	frequent	94	107	67	66	67

Notes:

[1] Determine if event is frequent; occasional or infrequent event. Refer to Table 7-1 for definition.

[2] Distances measured from centerlines of existing tracks to faces of buildings.

[3] Generalized Ground Surface Vibration Curve (Figure 10-1) for rapid transit or light rail vehicles at 50 mph.

[4] Highest vibration level, from the Generalized Vibration Curve (Figure 10-1), of either Track 1 or Track 2 at each receptor. The example project assumes the same adjustments are applied to both tracks. If the same adjustments cannot be applied to all tracks, the analyst may have to apply adjustments to the tracks individually to determine the highest predicted vibration at each receptor.

The "Predicted No-Build" is the "No-Build Scenario CREATE Program Train Vibration Level (Design Year)" which includes all train vibration from no-build scenario (design year) trains operating on tracks affected by the CREATE Program.

Vibration General Assessment Report Form For **No Build Alternative**
Vibration Adjustment Factors **Freight Rail Car**
CREATE Project WA7

	Unadjusted	No Build Adjustments									Adjusted	
		Speed Adjustments		Source Adjustments		Path Adjustments			Receiver Adjustments			
Receptors	Highest[1] Vibration Level @ 50 mph at Each Receptor No-Build (VdB)	Average Track Speed - No-Build (mph)	Speed Adjustment No-Build (VdB)	Vehicle[2] Condition Existing (VdB)	Elevated Structure[3] Adjustment Existing (VdB)	Propagation Geology[4] Adjustment Existing (VdB)	Wood Frame Structure (VdB)	Masonry Structure (VdB)	1-5 Floors Above Grade (VdB)	Floor Amplifi-cation (VdB)	No-Build Vibration (VdB)	No-Build GBN (dBA)
WA7-R-25	70	13.7	-11	10	-5	10	0	-7	-2	6	71	21
WA7-R-26	61	13.7	-11	10	-5	10	0	-7	-2	6	62	12
WA7-R-35	63	13.9	-11	10	-5	10	0	-7	-2	6	64	14
WA7-R-39	69	13.9	-11	10	-5	10	-5	0	-2	6	72	22
WA7-R-47	64	13.9	-11	10	-5	10	0	-7	-2	6	65	15
WA7-C-02	63	11.8	-13	10	-5	10	0	-7	0	0	58	8
WA7-S-02	64	12.7	-12	10	-5	10	0	-7	0	0	60	10
WA7-R-50	72	12.7	-12	10	-5	10	-5	0	-2	6	74	24
WA7-R-52	70	12.7	-12	10	-5	10	-5	0	-2	6	72	22
WA7-S-03	67	12.7	-12	10	-5	10	0	-7	0	0	63	13

Notes:

[1] Highest Vibration Level, from the Generalized Vibration Curve (Figure 10-1), of either the Southbound (Track 1) or Northbound (Track 2) at each receptor.

[2] Worn wheel adjustment made for Freight Rail Car. For locomotives assume no worn wheel adjustmen

[3] The existing tracks are on elevated structure/embankment (they are at least 1 feet higher than the base elevation at all receptors).

[4] Existing geological conditions assumed to have "efficient" vibration propagation

The "Predicted No-Build" is the "No-Build Scenario CREATE Program Train Vibration Level (Design Year)" which includes all train vibration from no-build scenario (design year) trains operating on tracks affected by the CREATE Program.

Figure 1- a
WA7 - South
Noise Analysis

January 2014

Legend

0 125 250 500 Feet

N

Noise Measurement Site

Noise Receptor

No Impact

Moderate Impact

Receptor Cluster

Screening Distance - Noise

WA7 Proposed Alignment

750 Feet

750 Feet

1200 Feet

750 Feet

750 Feet

WA7-P-02

WA7-R-47

WA7 - N2

WA7 - N1

WA7-R-39

WA7-R-43

WA7-R-34

WA7-R-33

WA7-R-38

WA7-R-35

WA7-R-16

WA7-R-18

WA7-S-01

WA7-R-17

WA7-R-14

WA7-R-15

WA7-R-19

WA7-R-25

WA7-R-26

WA7-R-24

WA7-R-23

WA7-R-01

WA7-R-02

WA7-R-03

WA7-R-04

WA7-R-05

WA7-R-07

WA7-R-08

WA7-R-12

WA7-R-13

WA7-P-01

Stevenson Xp

Bross Av

33rd St

Artesian Av

34th St

34th Pl

35th St

Claremont Av

Oakley Av

Western Av

35th Pl

Washtenaw Av

California Av

Francisco Av

Mozart St

Rockwell St

Maplewood Av

Campbell Av

36th St

36th Pl

37th St

37th Pl

38th St

38th Pl

39th Pl

40th St

Archer Av

Talman Av

Brighton Pl

Western Bv

Pershing Rd

Figure 1- b
WA7 - North
Noise Analysis

January 2014

Legend

0 125 250 500 Feet

N

Noise Receptor

- No Impact
- Moderate Impact
- Noise Measurement Site
- Screening Distance - Noise
- Receptor Cluster
- WA7 Proposed Alignment

WA7-R-56
WA7-R-59
WA7-S-03
WA7 - N4
WA7-R-53
WA7 - N3
WA7-R-52
WA7-R-49
WA7-R-58
WA7-C-02
WA7-R-02
750 Feet
750 Feet

21st Pl
Rockwell St
Cermak Rd
Oakley Av
22nd Pl
23rd Pl
24th St
24th Bv
24th Pl
Luther St
25th St
25th Pl
26th St
26th Pl
California Bv
California Av
Washtenaw Av
27th St
28th St
Artesian Av
Claremont Av
Blue Island Av
31st St
31st Bv
Western Bv
Western Av

Figure 2- a
WA7 - South
Vibration Analysis

January 2014

Legend

0 125 250 500 Feet

N

Vibration - Potential Impact?

- No
- Yes
- Receptor Cluster
- Screening Distance - Vibration (200 feet)
- WA7 Proposed Alignment

WA7-R-47
WA7-R-39
WA7-R-35
WA7-R-25
WA7-R-26
WA7-R-24
WA7-R-23

Stevenson Xp
Bross Av
33rd St
Artesian Av
Oakley Av
Claremont Av
34th St
34th Pl
35th St
35th Pl
Washtenaw Av
Mozart St
Francisco Av
Rockwell St
Maplewood Av
Campbell Av
Western Av
36th St
36th Pl
California Av
37th St
37th Pl
38th St
38th Pl
Archer Av
Western Bv
Pershing Rd
39th Pl
Talman Av
Brighton Pl
40th St

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 2- b
WA7 - North
Vibration Analysis

January 2014

Legend

0 125 250 500
Feet

N

Vibration - Potential Impact?

- No
- Yes
- Receptor Cluster
- Screening Distance - Vibration (200 feet)
- WA7 Proposed Alignment

WA7-S-03
WA7-R-52
WA7-R-50
WA7-C-02
WA7-S-02

21st Pl
Cermak Rd
Oakley Av
22nd Pl
23rd St
23rd Pl
Washtenaw Av
Rockwell St
24th St
24th Bv
24th Pl
Luther St
25th St
25th Pl
Artesian Av
Claremont Av
Blue Island Av
26th St
26th Pl
California Bv
27th St
28th St
31st St
31st Bv
Western Bv
Western Av

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community